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PM451

vertex

THE MAGAZINE OF SCIENCE FICTION



WATER—
Tomorrow Will
There Be Enough?

The Solar System's
Neglected Majority

OUR UNIVERSE—
Is It Limited?

Vertex Interviews
ROBERT
SILVERBERG



NOVEMBER 1, 1952 — A STAR COMES TO EARTH

On July 16, 1945, scientists exploded the first atomic device, at Alamogordo, New Mexico, and, when they heard about it, most people of that time thought that the ultimate weapon had been created. Little did they know, though, that scientists were already hard at work on bringing the very power of the sun to the surface of the Earth.

The atomic bomb fissions uranium atoms, and during the course of the fissioning one-tenth of one percent of the mass is converted into energy—the energy that makes up the explosion.

William Draper Harkins, an American chemist, wrote a paper on the conversion of hydrogen atoms to helium atoms by fusion. He figured that, in the course of the fusion, one-half of one percent of the mass would be converted into energy.

Since this reaction could not take place at temperatures under those found near the center of the sun, the paper received little notice. It became textbook theory that, at a temperature of millions of degrees, two protons may unite, fuse, and after emit-

ting a positron and a neutrino, become a deuterium nucleus. A deuterium nucleus may then fuse with a proton to form a tritium nucleus, which can fuse with still another proton to form helium. This remained a textbook theory, though, until Hans Albrecht Bethe, in 1938, postulated that this was the reaction taking place on the sun.

Once it was known that such a theoretical reaction actually could take place, the scientists once again got interested. There was no way, though, to produce the temperatures necessary to start the fusion here on Earth—at least not until July 16, 1945.

Suddenly, with the explosion of the first fission bomb, scientists had a "trigger," a heat source which could provide the temperatures necessary to start a hydrogen-helium reaction. A *thermonuclear* reaction.

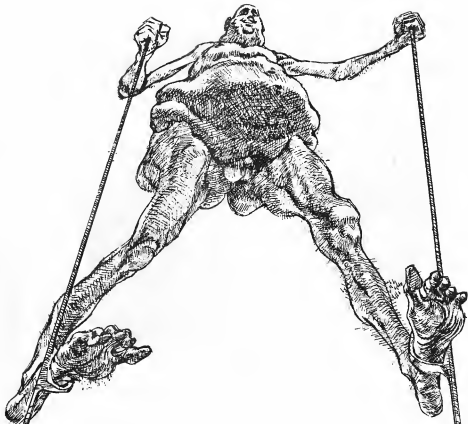
They had the match, but it was quite a while before the scientists managed to build the bomb for the match to light, as several seemingly insurmountable problems cropped up, not the least of which was the

fact that the "hydrogen," actually a mixture of deuterium and tritium, had to be liquefied to get it into a dense enough mass to go off, which meant that the whole thing had to be kept at just a few degrees above absolute zero. Later this problem was solved by using a slightly different form of thermonuclear fuel, but at the time it presented the scientists with quite a problem, especially since the military wasn't looking for a super-refrigerator. They wanted a bomb they could carry on an airplane.

Finally the scientists got all the bugs ironed out, and on November 1, 1952, on a lonely island in the Pacific, the first hydrogen bomb was exploded, yielding 10 megatons of energy, the equivalent of 10 million tons of TNT. In 7 short years the bomb scientists had produced a weapon fully 500 times as powerful as the 20 *kiloton* "doomsday" weapon which had destroyed Hiroshima. But they had also mastered the power of the sun, the ultimate reaction which may, if used wisely, make man the master of the universe. ○

Illustration by
Monte Rogers for
We Ate The Whole Thing,
fiction by Harry Harrison—
with the human race
drowning in its own pollution,
do the polluters care
or would they just keep
right on polluting?

RAY BRADBURY
ROBERT SILVERBERG
LARRY HOLDEN
HARRY HARRISON
LARRY NIVEN
HERMAN WREDE
GREGORY BENFORD
ED BRYANT
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NOVELETTE



All the Sounds of the Rainbow

Norman Spinrad

Scrambled sense impressions, changing from minute to minute, and the ability to transmit those sense impressions to others, can make one an instant Guru.

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William Rotsler

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As the editor of a science fiction magazine I am (a) interested in, and (b) a supporter of *Science*. Therefore, it is with heavy heart that I take typewriter in hand to compose this editorial, in which I am forced to say to the scientists, "Hold it! You're ruining things!"

No, I'm not talking about what science (or, more properly, technology) is doing to the ecology of our planet. What I'm talking about is what science is doing, directly and with malice aforethought, to science fiction.

It was bad enough when scientists decided that Mercury turned on its axis more than once every 88 days, which meant that there was no darkside and sunside, and more importantly, no twilight belt, which ruined reams of excellent old Mercury stories. That was a hard blow to take, but when the scientists summarily banished the fetid swamps and dripping rain forests of Venus, trying to tell us that Venus was dry and some 800 degrees hot at the surface, it was almost too much.

No sooner was science fiction beginning to recover from those two disasters than the Apollo thing came along, and NASA insulted each and every one of us by (a) trying to tell us that they had landed men on the moon, a fact we would have accepted with joy if it hadn't been for (b), the lousy sets they used. Right up through Apollo 17 they've used those same cheap movie sets, and it was painfully obvious to every red-blooded science fiction fan that those backgrounds weren't really the moon. Where were the jagged crater walls, the powdery dust, the twenty-foot gliding strides? No—obviously those TV transmissions were actually coming from a sound stage at the Grumman plant on Long Island, and NASA had spent so much money on the boosters that they could no longer afford good sets.

You'd think that this was enough, but no, science wasn't through trying to ruin us. They went and sent a Mariner to Mars to take pictures, and destroyed literally hundreds of books about the red planet. The Grand Canal will never again be illuminated by the pearly light of the hurtling twin moons of the ancient red planet. No longer will intrepid explorers have to depend on masks and compressors to thicken the thin, cold oxygen as their sand-cat churns through the red desert wastes. The atmosphere's too thin, it doesn't have any oxygen in it, and the red desert is a dim, cratered wasteland that looks like those above-mentioned phoney moon sets.

Now, just to cap things off, they have pushed the frontiers of ruination all the way out to the asteroid belt which they have decided doesn't even exist. No clouds of rocks and sand. No millions of orbiting bodies between Mars and Jupiter. No necessity to creep along keeping a close eye on the Doppler-radar to prevent collisions. Just the large bodies and the normal space debris, with "junk" density about the same as it is in space between Earth and Mars.

How much farther are you guys going to go? How many more things are you going to ruin for science fiction? How are you going to explain away the red spot? How ugly are you going to make the rings of Saturn? What tricks are you going to use to prove that the moons of Saturn and Jupiter are just lumps of shapeless rock, lifeless and of no interest? Come on, you guys. We've been bragging for years that scientists are big science fiction fans—that's been one of the saving graces when people accused us of reading "that junk." But how can we keep you for our own if you stay on your crusade to ruin science fiction? Can't you lie just a little bit? Please?

Donald J. Pfeil

Don Pfeil, Editor

NEWS & REVIEWS

News notes from the world of science and the arts—from space to the prehistoric past—From business contracts to book reviews—from ecology to spacecraft environmental systems.

APOLLO CREW IS NAMED

The selection of the United States flight crew for the 1975 Apollo-Soyuz Test Project mission was announced by NASA.

Prime crewmen for the joint U.S.-Soviet Union earth orbital space flight are Astronauts Thomas P. Stafford, commander; Vance D. Brand, command module pilot; and Donald K. Slayton, docking module pilot.

Backup crewmen are Astronauts Alan L. Bean, Ronald E. Evans, and Jack R. Lousma.

Target launch date for the mission is July 15, 1975. The Soyuz spacecraft will be launched first from the Soviet Union and the Apollo launch from the Kennedy Center, Florida, will follow. Apollo will have five launch windows; the first of which will begin 7½ hours after the Soyuz liftoff.

The American and Soviet crews will visit one another's spacecraft while the Soyuz and Apollo are docked in earth orbit for a maximum period of two days. The mission is designed to test equipment and techniques that will establish international crew rescue capability in space, as well as permit future cooperative scientific missions.

The first joint crew training session is scheduled for this summer when Soviet cosmonauts will visit the U. S. for several weeks. American astronauts will spend an equal amount of time in Russia beginning next fall. Future training sessions will be scheduled, based on experience gained from these visits.

Stafford, 42, an Air Force brigadier general, is one of NASA's most experienced and senior astronauts. Since his selection by NASA in September

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The U.S. half of the Apollo-Soyuz crew. From left to right, Donald K. Slayton, Vance D. Brand and Thomas P. Stafford. NASA Photo.

QUASAR AND EARTHQUAKES

The great explosive space objects called quasars, a billion light years away, may enable scientists to measure earth movements as small as a half-inch and help predict earthquakes along the San Andreas Fault.

The way-out fault-minding system is being developed by a team of Jet Propulsion Laboratory scientists and engineers, aided by geophysicists at Caltech's Seismological Laboratory.

Experiments for the new research concept called ARIES—for Astronomical Radio Interferometric Earth Surveying—are being conducted with the towering 210-foot antennas of the Deep Space Network at Goldstone near Barstow.

USE OF RADIO SIGNALS

Basically, according to JPL scientists Dr. J. L. Fanelow and Dr. J. B. Thomas, the system will use quasar radio signals received at two or more antennas to establish a time interval that can be deduced as distance between the antennas to a current accuracy of about one inch.

"The discovery of amazingly energetic sources of radio signals from outside our own galaxy—quasars and radio galaxies—provide a single source so distant that their positions appear to remain fixed," explained Peter F. MacDoran, JPL team leader.

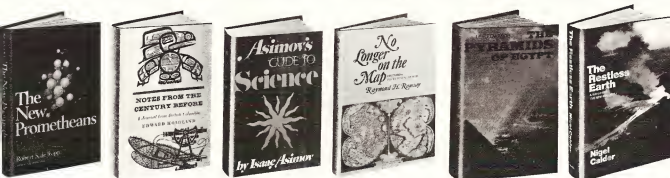
"They thus provide a very stable reference for measuring angles. ARIES antennas will be used to receive signals from identical space sources to establish the difference in arrival times.

High-speed digital computers then will be used to calculate the distance

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JUPITER'S RED SPOT

That giant red spot on the planet Jupiter may be nothing more than hot air, according to a Caltech scientist.

Dr. Andrew B. Ingersoll, associate professor of planetary science at Caltech, says that 20,000 mile long, 8,000 mile wide splotch which has long puzzled astronomers may simply be a huge hurricane-like spiral of hot gasses. The gasses, Ingersoll said, have punched through Jupiter's thick atmosphere and then remained there.

"The mass of the atmosphere below the banded clouds that we observe through a telescope acts like a fly-wheel," Ingersoll said. "It tends to damp out any change.

"Any large disturbance in the visible cloud surface would have to drag along an atmosphere thousands of miles thick. So the cloud layers—and Jupiter's Great Red Spot—are locked into a pretty stationary pattern."

SPACE POETRY

HOUSTON—En route to the moon astronaut Harrison H. Schmitt suggested that only a poet could truly express the beauties of outer space.

Then Schmitt turned poet himself, reading this bit of original verse to Mission Control:

It's the week before Christmas and all through the LEM, not a commander was stirring, not even Cernan.

The samples were stowed in their places with care, in hopes that with you, they soon will be there.

And Gene in his hammock and I in my cap had just settled our brains for a long-short lunar nap.

But up on Comm loop (communications circuit) there rose such a clatter, I sprang from my hammock to see what was the matter.

The sun on the breast of the surface below gave the lusture of objects, as if in the snow.

And what to my wondering eyes should appear, but a miniature Rover and eight tiny reindeer.

And a little old driver so lively and quick, I knew in a moment, it must be St. Nick.

I heard him exclaim as over the hills he did speed, Merry Christmas to all and to all, Godspeed."



Paul M. Muller and William L. Sjogren

Moon Scientists Win Prize

Two Jet propulsion Laboratory scientists shared a NASA award of \$10,000 for their 1968 discovery of mascons, mass concentrations of dense material beneath the surface of the moon.

Paul M. Muller and William L. Sjogren were named for the honor by NASA administrator, Dr. James C. Fletcher on recommendation of the space agency's inventions and contributions board, which made a detailed evaluation of the merits of the discovery.

The mascon discovery and the imaginative interpretation of its results

and implications by the two scientists proved of significant value to the Apollo program and should be equally important in future studies of the Earth and other planets, officials said.

Muller and Sjogren had only earth tracking stations and radio stations to and from the unmanned Lunar Orbiter 5 spacecraft to provide the information from which they developed precise lunar gravity data for the first time.

They studied spacecraft speed changes indicated in the frequency differences between transmitted and received signals and found in plotting the results that the orbiter accelerated and decelerated each time it overflew any one of five circular dry seas, Imbrium, Serenitatis, Crisium, Nectaris and Humorum.

This led the two scientists to conclude that the velocity variations were caused by subsurface concentrations of mass (mascons) at the approximate centers of the dry seas.

The information provided a precise spacecraft navigational model for Apollo flights, which subsequently confirmed the Muller-Sjogren analysis and identified additional mascon areas—a total of 12—on the moon.

A STAR IS BORN

Three Caltech scientists report they have spotted a cluster of embryonic stars developing in a cloud of hydrogen and dust only 10,000 light-years away in our own Milky Way galaxy.

Drs. Gareth Wynn-Williams, Eric Becklin and Gerry Neugebauer attached very sensitive infrared detectors to the Hale Observatory's 100-inch and 200-inch diameter telescopes and scanned a vast interstellar cloud designated W3 by astronomers.

Because some unusual objects had previously been found in W3 by astronomers, the astronomers decided to search the cloud for signs of stars that might still be in the formative phase.

But hydrogen and dust particles floating in W3 made visual sightings impossible and so the astronomers had to use the infrared instruments to detect the radiation emitted by the forming stars.

One of the embryo stars has been named IRS-5—not for Internal Revenue Service form, but for Infrared Source #5. It is one of seven such objects that appear to be enveloped

by W3.

IRS-5 is said to be about the same mass as our own sun, but its volume is enormously bigger; it has a diameter of between 8 billion and 10 billion miles, compared to the sun's 860,000-mile diameter. Its temperature is only 170 degrees Fahrenheit, which is almost frosty compared to a mature star's average surface temperature of 5,000 degrees or more.

As IRS-5 matures, however, its own gravitational attraction will cause it to shrink and become more compact. And when that happens, nuclear reactions will begin, temperatures will climb, visible light will be given off—and a full-fledged star will be born.

Witnessing the evolution of a star is a rare event, although some astronomers believe it is a continuous process in this and other galaxies. Only one other "proto-star" (or stellar embryo) is known to astronomers with any certainty. It is located in the constellation Orion.

But the Caltech astronomers said IRS-5 is much more energetic than its counterpart in Orion and might eventually grow up to become an exceptionally bright star.

Ten little losers, standing in a line. One bought our magazine. Then there were nine.



Since hamburger prices went through the roof, Alice feeds her kids hot dogs instead. She doesn't know that ground beef may be a better buy for nourishment, or that a plain old peanut-butter sandwich could be better yet.

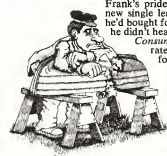
Bill didn't trust his thermostat, so he bought a \$5 household thermometer to check it. Now he's completely confused—and he could have solved his problem for 69¢.



A range with a self-cleaning oven was Chris's dream come true. Six months, two burns, and a tough scrubbing later—she wished she'd checked *Consumer Reports* before she picked out her dream machine.



Debbie's motto was, "you get what you pay for," so she paid \$400 for a zigzag sewing machine. She didn't know that her nylon tricot blouse would have turned out better on the \$250 machine she bypassed.



Frank's pride and joy was the new single lens reflex camera he'd bought for \$460. Too bad he didn't hear about the one *Consumer Reports* rated just as good for \$140 less.



When Ed decided to refinish his boat, he spent \$3.20 a quart for paint remover. If he'd known better, he could have saved 55¢ a quart—and stripped it cleaner in half the time.



Grace made sure that the whitening, cavity fighting brand she had to learn the hard way that what's good for the kids may not be good for grown-ups.



Handyman Henry is nobody's fool; he knew that the \$45 sabre saw the salesman was pushing was no better than the \$24 model he bought. Unfortunately, he didn't see the \$17 saw that was better than both of them.



Ida listened to a half dozen compact stereo systems before she chose her \$250 set. How could she guess that a model that cost just \$1 more would give her a lot more value for her money.

Johnny decided he'd wasted his last dollar on noisy outboard motors that jammed in weeds, one-coat paints that didn't cover, air-conditioners that dripped puddles onto his patio, door locks that all but invited burglars to break in, luggage that ended up without handles, washing machines that walked across the floor, and products that just weren't worth the price. He subscribed to *CONSUMER REPORTS*.

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LIFE ON MARS

The chance of finding primitive life forms—past or present—on Mars appeared somewhat better when scientists presented the latest findings of Mariner 9, the spacecraft that orbited the red planet for more than half a Martian year.

Whatever the probability assigned to life on Mars five years ago, it must be much higher now, the Washington panel agreed, because of growing evidence that liquid water has existed on the planet.

The possibility of organic life on the planet arose when the Jet Propulsion Laboratory spacecraft returned intriguing pictures last year of surface channels that appeared to have been cut by water.

At that time some scientists said they had tried hard to find some mechanism other than water that could have created several types of channels, but failed.

Some scientists disagreed with the water concept, saying that temperatures and pressures at the Martian surface preclude free water even though water vapor may have been spewed into the Martian atmosphere by volcanoes.

Panelists said they believe the water episodes on Mars were not a one-time happening because of evidence that the planet, like earth, has undergone repeated episodes of colder and warmer times.

Such cycles, they said, might have been caused by the changing orbit of Mars, due to the influence of other planets, which in times past could have brought it nearer to the sun to create climate changes that would permit liquid water to exist.

"We see these channel features and it is difficult to make theoretical arguments as to why there can't be water on Mars when we study evidence of what appears to have been large amounts of water," one panelist said.

But another pointed out that physical understanding of how the mysterious channels could occur is far from complete.

"If you could imagine an atmosphere as dense as the earth's, with as much carbon dioxide and as much water, moved to the orbit of Mars, there would still be no liquid water," he said. "It would all be frozen."

Other new science results from the

/turn to page 12



San Onofre Nuclear Power Station

UNDERGROUND POWER PLANT

Underground nuclear power stations might be less subject to damage from earthquake shaking than stations built on the surface, a Cal-tech research engineer testified in San Diego.

He said the nature of seismic waves traveling over the surface emphasizes the "limberness" of surface buildings. That is, the top and middle stories shake more violently than the ground floor and basements.

The witness, Martin Goldsmith, said it is possible that underground buildings, such as the components of a nuclear power plant, could be fixed not only to the floor of underground galleries, but also to the sides and ceilings. All building elevations then would probably shake in unison, re-

ducing structural damage from the quake because all parts would move without crunching together.

Goldsmith said this had not been proved but he believed it was a possibility. The only way to prove the feasibility of underground nuclear stations is actually to build one, he said.

The underground galleries he described as practical and feasible would be under at least 200 feet of rock.

That many feet of rock would be necessary to prevent a rupture to the surface ground in case of the greatest imaginable nuclear accident to the subterranean reactors, Goldsmith said.

The study found that a span of 100 feet would be practical for the underground galleries. Goldsmith said that span, or width, is the vital measurement, since the galleries conceivably could be of any desired length and height.

"The ultimate practicality of underground nuclear stations can only be determined by actually building one, but our studies have found so far no insurmountable difficulties," Goldsmith said.

If the underground plant had to be built a considerable distance from the ocean it might be necessary to reuse water for cooling, letting it run all through cooling towers or stand in ponds between uses.

Goldsmith said present components of nuclear plants could be put underground without substantial design changes. Suitably strong rock would have to be found, however.

QUASAR, from page 6

between antennas which can be separated by a distance as short as a few miles or by intercontinental ranges.

Goal of the research, MacDoran said, is to measure movements as small as one-half inch along the San Andreas Fault.

Geophysicists are most interested, he said, in determining how the earth's crust bends and stretches near what is known as a "locked fault zone" and on out to where large pieces of the crust drift freely. These are called tectonic plates.

"When the bend or stretch becomes too great, something breaks and we have an earthquake," the JPL scientist added.

The San Andreas Fault, lying at the junction of two of the world's major tectonic plates, is fertile ground for geophysical study of the North Pacific

and North American plates, he said.

But the relative northward movement of the Pacific plate—calculated at 2 to 6 centimeters a year—has a range of uncertainty that is important in earthquake study.

1906 S.F. QUAKE

As an example, the disastrous San Francisco earthquake of 1906 was produced by a sudden 4-meter slip along the San Andreas Fault in Northern California.

Since then, MacDoran said, the San Andreas Fault in that area has been locked, and strain is again being stored.

"If the rate of storage is 2 centimeters a year," he said, "an earthquake the size of the 1906 quake would not occur again until about the year 2100, but if the rate is 6 centimeters a year, such an earthquake could occur at any time."

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ASTRONAUT TO LEAVE NASA

Astronaut James A. Lovell, Jr., a veteran of four space flights and a member of the first crew to circle the Moon, announced he will leave NASA and retire from the Navy, March 1, to accept a position in private industry.

Lovell, 44, will become senior Executive Vice President of Bay Houston Towing Company, a Houston-based water transport and harbor towing firm with diversified interests in shipping, agriculture, mining, ranching and oil and gas.

Lovell has been Deputy Director of Science and Applications at the NASA Manned Spacecraft Center since May, 1971, with primary responsibility for the Apollo lunar science program at MSC.

Lovell said his decision to leave the space program was one of the most difficult of his life. He said, "I am sure the opportunity of making four space flights—including two lunar missions—will remain an experience without equal in my life. I hope these missions have contributed significantly to Man's understanding of the Universe."

"I feel privileged to have been a part of the Apollo program," Lovell said, "and I am particularly grateful to have had an opportunity to absorb part of the management expertise of Apollo."

MSC Director Christopher C. Kraft Jr., said "Jim Lovell has made many significant contributions to his country through his outstanding performance while he was an astronaut. These not only include his many hours in space, but his untiring efforts in promoting physical fitness and his most recent managerial activities. We wish him well in his future and know he will succeed in what he sets out to accomplish. I personally will miss his presence at MSC."

Lovell will retire from the United States Navy with the rank of Captain after 21 years of commissioned service. He has been assigned to NASA by the Navy since September, 1962, when he became one of the second group of astronauts to be selected for the U. S. space program.

Lovell was commander of the Apollo 13 mission, which was to have landed in the upland Fra Mauro region of the Moon in April, 1970. The mission was aborted after an explosion dis-

abled command module oxygen and electrical systems, and Lovell and his fellow crewmen, Fred W. Haise and John L. Swigert, Jr., had to make hazardous circum-lunar return to Earth using the lunar module as a lifeboat.

Lovell was also a member of the Apollo 8 crew which first circled the Moon at Christmas 1968. Lovell commanded the Gemini 12 mission, which successfully concluded the Gemini program in November, 1966. And he flew on the 14-day Gemini 7 mission, which set a space endurance record and completed the first rendezvous of two manned, maneuverable spacecraft in December, 1965, as Gemini 7 was joined in orbit by Gemini 6.

Lovell has spent more time in space than any other human being—a total of 715 hours or nearly 30 days.

LIFE ON MARS, from page 10

Mariner 9 mission included finding that volcanic action on the planet occurred billions of years ago as well as relatively recently.

The first extinct volcano photographed after a great Martian dust storm had subsided, was relatively new, indicated by sparse cratering.

There is evidence, too, of a basic planetary structure similar to that of Earth, with vast areas that could correspond to continental shelves and

huge dry basins analogous to earth's oceans.

The report disclosed, also, that the composition of clouds associated with the high Martian areas of Nix Olympica and North, Middle and South spots were identified with ice crystals, analogous to terrestrial cirrus clouds. And it was announced that the amount of ozone (a molecular form of oxygen) has been found to vary in the Martian atmosphere at the seasons change—ozone in the polar regions during the fall, winter and spring with none in the equatorial region during any season.

When ozone is present, it was explained, some of the ultraviolet radiation is absorbed before it reaches the surface.

From laboratory experiments, it is known that ultraviolet radiation promotes the formation of simple organic molecules under simulated Martian conditions.

But it is also known that ultraviolet radiation prevents complicated organic molecules from forming.

It is possible, then, that the seasonal variation of ozone on Mars would permit both simple and complicated organic molecules to form, the report stated, then added, "but this again depends on other conditions, especially the presence or absence of liquid water at the surface."



NASA's artist's concept of the Apollo-Soyuz docking mission scheduled for mid-1975.

APOLLO CREW, from page 6

1962, he has logged 290 hours and 15 minutes in space in two earth orbital flights and one lunar orbital mission—Geminis 6 and 9 and Apollo 10. He served as Chief of the Astronaut Office, and since June 1971, he has been Deputy Director of Flight Crew Operations. He is a native of Weatherford, Oklahoma.

Brand, 41, a civilian, is the backup commander for the second and third manned Skylab missions scheduled to be flown this year. Selected as an astronaut in April 1966, he served as a crew member for the thermal vacuum testing of the prototype Apollo command module and was an astronaut support crewman for the Apollo 8 and

13 missions. He was backup command module pilot for Apollo 15, and he has participated in operational support roles for other Apollo missions. Brand was born in Longmont, Colorado.

Slayton, 48, a civilian, is one of the original seven astronauts selected in April, 1959. He was scheduled to pilot the Mercury 7 mission, which flew in May, 1962 but was relieved of that assignment when a heart condition was discovered. He was named Coordinator of Astronaut Activities and since November, 1963, has been Director of Flight Crew Operations. In March, 1972, following a comprehensive medical review, Slayton was restored to full flight status. He is a native of Sparta, Wisconsin.

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Harry Harrison's "We Ate The Whole Thing," which appeared in Vertex Number One, served as the springboard for the novel "Make Room, Make Room," which MGM has retitled:

SOYLENT GREEN

Metro-Goldwyn-Mayer's newest film release, "Soylent Green," paints a gripping celluloid picture of the world in year 2022. For a few hours we are hypnotized by a planet almost on the gulf of extinction and slowly suffocating in a poisonous polluted atmosphere.

New York becomes a teeming city of 41 million hungry and abused citizens. The general living quarters range from interiors of subway trains, abandoned automobiles and filthy hallways of grossly overpopulated tenements to plush apartments reserved for the extremely rich and powerful, which come with permanent mistresses called "furniture."

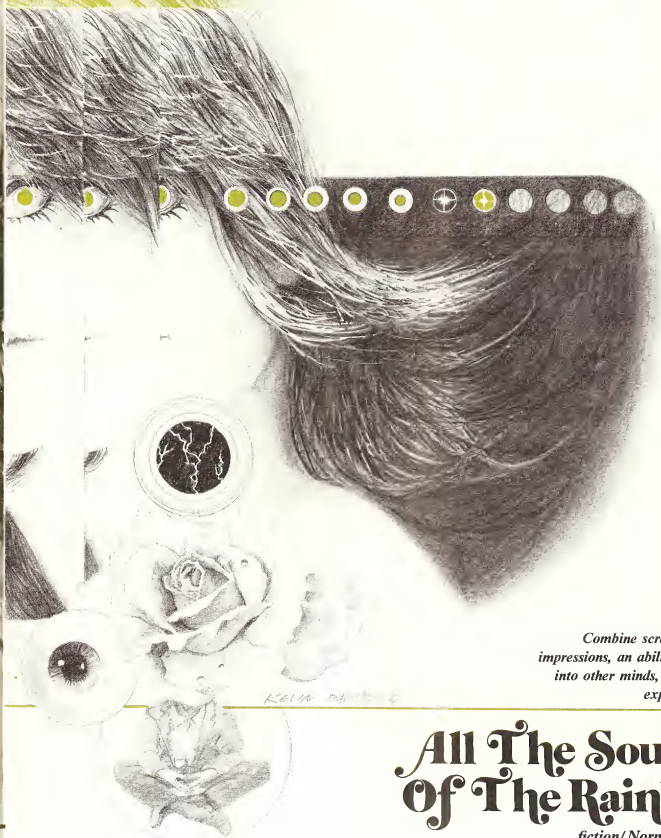
Unless one can afford the exorbitant black market prices for real food—a pound of beef or a jar of strawberry jam sell for \$50 each—survival de-

/turn to page 98



Charlton Heston stars as Thorn, one of the harassed and overworked detectives of New York City fifty years from now, when 41 million people and chronic food shortages make life a cheap commodity indeed.





*Combine scrambled sense
impressions, an ability to project
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experience. . .*

All The Sounds Of The Rainbow

*fiction/Norman Spinrad
art/Kevin Davidson*

Harry Krell sprawled in a black vinyl beanbag chair near the railing of the rough-hewn porch. Five yards below, the sea crashed and rumbled against convoluted black rocks that looked like a fallen shower of meteors half-buried in the warm Pacific sand. He was naked from the waist up; a white sarong fell to his shins, and he wore custom-made horseshide sandals. He was well-muscled in a fortyish way, deeply tanned, and had the long, neat, straight yellow hair of a beach-bum. His blue eyes almost went with the beach-bum image: clear, empty, but shattered-looking, like marbles that had been carefully cracked with a ballpeen hammer.

As phony as a Southern California guru, Bill Marvin thought as he stepped out onto the sunlit porch. Which he is. Nevertheless, Marvin shuddered as those strange eyes swept across him like radar antennae, cold, expressionless instruments gathering their private spectrum of data. "Sit down," Krell said. "You sound awful over there."

Marvin gingerly lowered the seat of his brown suede pants to the edge of an aluminum-and-plastic beachchair and stared at Krell with cold gray eyes set in a smooth angular face perfectly framed by medium-length, razor-cut, artfully styled brown hair. He had no intention of wasting any more time on this oily con-man than was absolutely necessary. "I'll come right to the point, Krell," he said. "You detach yourself from Karen your way, or I'll get it done my way."

"Karen's her own chick," Krell said. "She's not even your wife any more." A jet from Vandenburg suddenly roared overhead; Krell winced and rubbed at his eyes.

"But I'm still paying her a thousand a month in alimony, and I'll play pretty dirty before I'll stand by and watch half of that go into your pockets."

Krell smiled, and a piece of chalk seemed to scratch down a blackboard in Marvin's mind. "You can't do a thing about it," he said.

"I can stop paying."

"And get dragged into court."

"And tell the judge I'm putting the money in escrow pending the outcome of a sanity hearing, seeing as how I believe that Karen is now mentally incompetent."

"It won't work. Karen's at least as sane as you are."

"But I'll drag you into court in the process, Krell. I'll expose you for the phony you are."

Harry Krell laughed a strange bitter



"Waves of thick velvet poured over Bill Marvin's body . . . he felt a radiant fire in a bitter cold night . . . he heard a chord that seemed to be composed of the chiming of a million microscopic bells."

laugh and multi-colored diamonds of stained glass seemed to flash and shimmer in the sun. "Shall I show you what a phony I am, Marvin?" he said. "Shall I really show you?"

Waves of thick velvet poured over Bill Marvin's body. In Krell's direction, he felt a radiant fire in a bitter cold night. He heard a chord that seemed to be composed of the chiming of a million microscopic bells. Far away, he saw a streak of hard blue metal against a field of loamy brown.

All in an instant, and then it passed. He saw the sunlight, heard the breakers, then the sound of a high-performance engine accelerating up in the hills that loomed above the beach house. Krell was smiling and staring empty off into space.

A tremor went through Marvin's body. I've been a little tense lately, he thought. Can this be the beginning of a breakdown? "What the hell was that?" he muttered.

"What was what?" said Krell. "I'm a phony, so nothing could've happened, now could it, Marvin?" His voice seemed both bitter and smug.

Marvin blotted out the whole thing by forcing his attention back to the matter at hand. "I don't care what little tricks you can pull, I'm not going to let you suck up my money through Karen."

"You've got a one-track mind, Mr. Marvin, what we call a frozen sensorium here at Golden Groves. You're super-uptight. You know, I could help you. I could open up your head and let in all the sounds of the rainbow."

"You're not selling me any used car, Krell!"

"Well, maybe Karen can," Krell said. Marvin followed Krell's line of sight, and there she was, walking through the glass doors in a paisley muumuu that the sea-breeze pressed and fluttered against the soft firmness of her body.

A ball of nausea instantly formed in Marvin's gut, compounded of empty nights, cat-fights in court, soured love, dead hopes, and the treachery of his body which still sent ghosts of lust coursing to his loins at the sight of the dyed coppery hair that fell a foot past her shoulders, that elfin face with carbon-steel behind it, that perfect body which she pampered and honed like the weapon it was.

"Hello Bill," she said in a neutral voice. "How's the smut business?"

"I haven't had to do any porn for four months," Marvin lied. "I'm into commercials." And then, hating himself for trying to justify his existence to her again, even now, when there was nothing

to gain or lose.

Karen walked slowly to the railing of the porch, turned, leaned her back against it, seemed to quiver in some kind of ecstasy. Her green eyes, always so bright with shrewdness, seemed vague and uncharacteristically soft, as if she were good and stoned.

"Your voice feels so ugly when you're trying not to whine," she said.

"Bill's threatening to cut off your alimony unless you leave Golden Groves," Krell said. "He wants to force a sanity hearing and prove that you're a nut and I'm a crook."

"Go ahead and pull your greasy little legal stunts, Bill," Karen said. "I'm sane and Harry is exactly what he claims to be, and we'd both be delighted to prove it in court, wouldn't we, Harry?"

"I don't want to get involved in any legal hassles," Krell said coldly. "It's not worth it, especially since you won't have a dime to pay towards your residency fee with all your alimony in escrow."

"Harry!"

Her eyes snapped back into hard focus like steel shutters, and the desperation turned her face into the kind of ugly mask you see around swimming pools in Las Vegas. Marvin smiled, easily choking back his pity. "How do you like your little tin guru now?" he said.

"Harry, you can't do this to me, you can't just turn me off like a lamp over a few hundred dollars!"

Harry Krell climbed out of his beanbag chair. There was no expression on his face at all; except for those strange shattered-looking eyes, he could've been any aging beach-bum telling the facts of life to an old divorcee whose money had run out. "I'm no saint," he said. "I had an accident that scrambled my brains and gave me a power to give people something they want and fixed it so that's the only way I can make a living. A good living."

He smiled, and broken glass seemed to jangle inside Bill Marvin's skull. "I'm in it for the money," said Harry Krell. "So you better clean up your own mess, Karen."

"You're such a rotten swine!" Karen snarled, her face suddenly looking ten years older, every subtle wrinkle a prophet of disaster to come.

"But I'm the real thing," said Harry Krell. "I deliver." Slowly and haltingly, he began walking towards the doors that led to his living room, like someone moving underwater.

"Bill..."

It was all there in his name on her lips two octaves lower than her normal

tone of voice, the slight hunch forward of her shoulders, the lost scared look in her eyes. It was a trick, and it was where she really lived, both at the same time. He wanted to punch her in the guts and cradle her in his arms.

"If you're crazy enough to think you're going to talk me—"

"Just let me walk you to your car. Please."

Marvin got up, brushed off his pants, sighed, and, suddenly drained of anything like emotion, said tiredly: "If you think you need the exercise that bad, lady."

They walked silently through a slick California-rustic living room, where Krell sat on a green synthetic fur-covered couch stroking a Siamese cat as if it were a musical instrument. On either side of him were a young male hippie in carefully-cut shoulder-length hair and a well-tailored embroidered jeans suit, and a minor middle-aged television actor whose name Marvin could not recall.

Marvin kept walking across the black rug without exchanging a look or a word with Krell, but he noticed that there was quick eye contact between Krell and Karen, and at that moment he felt the fleeting taste of cinnamon in his mouth.

Krell's private house fronted on a rich, rolling green plateau across the highway from the Pacific end of the Santa Monica Mountains. Rustic bungalows were scattered randomly about the property, along with clumps of trees, paths, benches, a tennis court, a large swimming pool, a sauna, a stable, the usual sensitivity-resort paraphernalia. The parking lot was tucked nicely away behind a screen of trees at the edge of the highway, so as not to spoil the bucolic scene. But the whole business was surrounded by a ten-foot chain-link fence topped by three strands of barbed wire, and the only entrance was a remotely-controlled electric gate. As far as Marvin was concerned, that pretty well summed up Golden Groves. This area north of Los Angeles was full of this kind of guru-farm; the only thing that varied was the basic gimmick.

"All right Karen, what's Krell's number?" he said as they walked toward the parking lot. "Let me guess . . . organic mescaline combined with acupuncture . . . tantric yoga and yak-butter massage. . . . Ye gods, what else is there that you haven't been hung up on already?"

"Synesthesia," she said in deadly earnest, "and it works. You've felt it your-

self, I could tell."

Uneasily, Marvin remembered the strange moments of sensory hallucination he had been getting ever since he met Krell, like short LSD flashbacks. Was Krell really responsible, he wondered? Better than turning out to be the results of too much acid, or the beginning of a nervous breakdown. . . .

"Harry had some kind of serious head injury three years ago—"

"Probably fell off his surfboard."

"—he was in a coma for three weeks, and when he came out of it, the lines between his senses and his brain were all crossed. He saw sound, heard color, tasted temperature. . . . Synesthesia, they call it."

"Yeah . . . now I remember I read about that kind of thing in *Time* or somewhere. . . ."

"Not like Harry, you didn't. Because with Harry the connections keep changing from minute to minute. His world is always fresh and new . . . like being high all the time . . . like . . . it's like nothing else in the world."

She brought him up short with a touch of her hand, and a flash from her eyes, perhaps deliberate, reminded him of what she had been, what they had been, when they first drove across the San Fernando Valley in the old Dodge, with the Hollywood Hills spread out before them, a golden world they were sure to conquer.

"I feel alive again, Bill," she said. "Please don't take it away from me." "I don't see—"

Overwhelming warmth enveloped his body. He tasted the wine of her hand on his arm. He heard the symphony of the spheres, tone within tone within tone, without end. He saw the dark of inky night punctuated with fountains of green, red, violet, yellow, fantastic flowers of light, celestial fireworks. He felt his knees go weak, his head reel; he was falling. The fountains of light exploded faster, became larger. He put out his hands to break his fall, smelled burning pine, heard the whisper of an unfelt wind.

He was crouched on the grass supporting his body-weight on his hands, staring down at the green blades. "Are you okay? Are you all right?" Karen shouted.

He looked up at her, blinked, nodded. "What Harry never let the doctors find out was that he could project it," she said.

Marvin got shakily to his feet. "All right," he said. "So I believe that that greasy creep Krell can get inside your brain and scramble it around! But what

the hell for? What dumb spiel does he throw you to make you want it, that you're experiencing the essence of Buddha's rectum or something?"

"Harry's no mental giant," she said. "He doesn't know why it opens you up—oh, he's got some stupid line for the real idiots—all he really knows is how to do it, and how to make money at it. But Bill, all I can tell you is that this seems to be opening me up at last. It's the answer I've been looking for five years."

"What the hell's the question?" Marvin said, an old line that brought back a whole marriage's worth of bad memories, like a foul-tasting burp recalling an undigested bad meal. Acid trips that went nowhere, two months of the Synanon game learning how to stick the knife in better, swinging, threesomes both ways, trial separations and trial reconciliations, savage sex, battle sex, dull sex, and no sex. Always searching for something that had been lost somewhere between crossing the continent together in that old Dodge and the skin-flick way of life that meant survival in Los Angeles after it became apparent that he wasn't the next Orson Welles and she wasn't the next Marilyn Monroe.

"What I think is that this synesthesia must be the natural way people are supposed to experience the world. Somewhere along the way our senses got separated from each other, and that's why the human race is such a mess. We can't get our heads together because we experience reality through a lot of narrow windows, like prisoners in a cell. That's why we're all twisted inside."

"Whereas Harry Krell is the picture of mental health and karmic perfection!"

They were nearing the parking lot now; Marvin could see his Targa, and he longed to be in it, roaring along the freeway away from Golden Groves and Karen, away from one more expensive last hope.

Once again, she presented him with her flesh, touching both hands to his shoulders, staring full face at him until something inside him ached with yearning. Her face was as soft as it had been when they had been lovers instead of sparring partners, but her eyes were full of an aging woman's terrors.

"All I know is what I feel," she said. "When I'm living in a synesthetic flash, I feel really alive. Everything else is just waiting."

"Why don't you just try smack?" Marvin said. "It may not be cheaper than Krell, but at least it's portable."

"Harry claims that eventually we can

learn to do it on our own, that we can restrain our minds, given enough time—"

"And enough money."

"Oh Bill, don't make me lose this! Don't let me drown!"

Her hands dug into his shoulders, her body slumped toward him, wrinkles formed in the corners of her mouth, the stench of pathetic desperation—

He saw huge woman's hands knotted in fear beside themselves in prayerful supplication towards him from a forest of sharp metallic edges. He felt her flesh moving over every inch of his body in long-forgotten personal rhythms, and how it had felt to snuggle toasty beside her in bed. He tasted bitter gall and the nausea of panic, smelled musky perfume.

He heard his own tears peeling like church bells as they rolled down his cheeks; he drew the giant hands to him, and they dissolved into an armful of yellow light. Wordless singing filled his ears, and he smelled a long night by the fireside, felt the fleshly warm glow of nostalgia's sad contentment.

He was holding Karen in his arms; her cheek was nestled against his neck. She was crooning his name, and he felt five years and more younger. And suddenly scared silly and burning mad.

He thrust her away from him. "It won't work," he snarled. "You're not going to play me for a sucker again and neither is Krell!"

"You felt—"

"What you and Harry Krell wanted me to feel! Forget it, it won't work again! See you in court."

He sprinted the rest of the way to his car, tearing little doubts out of the moist turf of Golden Groves.

With four underground films totalling less than 90 minutes to Bill's credit, and with Karen having "starred" in the last two of them, the Marvins had left New York to seek fame and fortune in the Golden West. What they found in Hollywood was that beautiful women with minor acting talent were a dime a dozen (or at best \$50 a trick) and that Bill's "credits" might as well have been Cuban Superman flicks.

What they also found out, after four months of starving and scrounging, was that Los Angeles was the pornography capital of the world. For every foot of feature film shot in Hollywood, there were miles of split beaver, S&M, and just plain stag films churned out. The town was swarming with "film-makers" living off porn while waiting for The Big Break and "actresses" whose footage could be seen to best advantage in Ro-

tary smokers or the string of skin flick houses along Santa Monica Boulevard known as Beaver Valley. Porn was such a booming industry that most of the film-makers knew less about handling a camera than Bill. So when the inevitable occurred, he had plenty of work and the Marvins had an abundance of money.

Seven years later, Bill Marvin was left with his excellent connections in the porn industry, a three-year-old Porsche Targa, a six-room house in Laurel Canyon which he would own outright in another fifteen years, enough cameras and equipment to live well off pornography forever, and no more illusions about Making It Big.

He was set for life. Sex, both instant and long-term, was certainly no problem in his line of work; four months of screwing around between serious relationships that averaged about six months in duration seemed to be his natural pattern. In the porn business, you connect up with a good lawyer and a tricky accountant early if you know what's good for you, so he had come out of the divorce pretty damn well: fifteen grand in lieu of her share of the house and \$1000 a month, which he could pay without feeling too much pain.

He had felt that he could breeze along like this forever, happy as a clam, until that scene last week at Golden Groves. Now he was rattling around the house as if it were the dead shell of some enormous creature that he was inhabiting like an over-ambitious hermit-crab. He couldn't get his head into a new project, sex didn't turn him on, drugs bored him. He could think of only one thing: Harry Krell's head on a silver platter. And the fact that his lawyer had told him that the sanity hearing ploy probably wouldn't work certainly hadn't improved his disposition.

What possible difference can it make to me that Karen is throwing my money away on Krell, he wondered as he paced the flagstone walk of his deeply-shadowed overgrown garden? If it wasn't Krell, it'd be some other transcendental con-man. The hills are full of them.

If this were a Universal TV movie, I'd still be carrying a subconscious torch for Karen, which is why Krell is getting under my skin. Guru-envy, a shrink might call it. But I wouldn't have Karen back on her hands and knees. No, it's got to be something about that crazy creep Krell—

That crazy Krell!

Bill Marvin did a classic slow-take. Then he double-timed through the ferns

and cacti of his hillside garden, trotted around the edge of his pool, through his living room, and two stairs at a time up to his second-floor office, where he called Wally Bruner, his hot-shot lawyer.

"Look Wally, about this con-artist my wife is—"

"I told you, you miss one alimony payment, and she'll have you in court as defendant, and unless you succeed in getting her committed—"

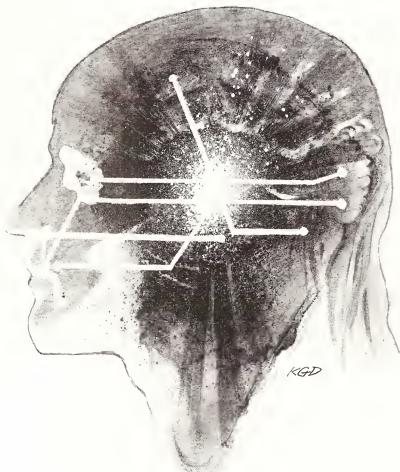
"Yeah, yeah, I know, I probably can't have her declared incompetent. But what about Krell?"

"Krell?" Wally's voice had slowed down about twenty mph. Marvin could picture him leaning back in his chair, raising his eyebrows, rolling the word around in his mouth, tasting it out.

"Krell?"

"Sure. This guy had a head injury so serious he was in a coma for weeks, and when he comes out of it, he claims he

*"... the lines between
his senses are all
crossed. He sees sound,
hears color, tastes
temperature.
Synesthesia, they call it,
and the connections
keep changing!"*



"... as the words emerged from her mouth they became brightly-colored tropical butterflies, and she became a lush greenness from which they flew."



sees sound, hears light, feels taste, and then he goes into business claiming he can scramble other people's brains the same way. What would that sound like in court?"

"Who swears out the complaint?" Bruner said slowly.

"Huh?"

"The only way to get Krell into court is on a fraud charge, that he can't really project this synesthesia effect, he's swindling the marks. That puts him in the position of having to defend himself against criminal fraud by proving he's got this strange psychic power, which, let me tell you, is not a position I'd care to defend. If I was his lawyer, I think I'd have to plead insanity to try to beat the felony rap. If he wins, he spends a few months in the booby hatch and this Golden Groves thing is broken up, which is what you want. If he loses he goes to jail, which you'd like even better. If he tries to convince a Los Angeles judge that he's got psychic powers, he won't get to first base, and if he tries it before a jury, I'll get him and his lawyer thrown in the funny-farm."

"Well hey, that's great!" Marvin shouted. "We got him coming and going!"

"Like I say, Bill," Bruner said tiredly, "who's the complainant?"

"In English, please, Wally."

"In order to get Krell into court on a fraud charge, someone has to file a complaint. Someone who can claim that Krell has defrauded him. Therefore someone who has paid Krell money for his hypothetical services. Who's that, Bill? Certainly not Karen—"

"What about me?" Marvin blurted.

"You?"

"Sure. I go up there, pay Krell for a month's worth, stay a few days, then come out screaming fraud."

"But according to you, he really delivers what he claims to..."

"As of now, I never told you that, right?"

"You'd have to testify under oath..."

"I'll keep my fingers crossed."

"You really think Krell will take a chance on letting you in?"

Bill Marvin smiled. "He's a greedy pig and an egomaniac," he said. "He tried to get Karen to help convince me he was Malibu's answer to Buddha, and he's more than jerk enough to convince himself that he succeeded. Will it work, Wally?"

"Will what work?" Bruner said ingenuously. "As of now, this phone conversation never took place. Do you read me loud and clear?"

"Five by five," Marvin said. He hung up on Bruner and dialed the number of Golden Groves.

Sprawled across his green couch, Harry Krell's body contradicted the lines of tense shrewdness in his face as his eyes, for once, focused sharply on Marvin. "Maybe I'm making a mistake trusting you," he said. "You made it pretty clear what you think of me."

Marvin leaned back in his chair, emulating Krell's casualness. "Trust's got nothing to do with it," he said. "You don't have to trust me and I don't have to trust you. You show me that you can give me my money's worth, that should convince me that Karen is getting my money's worth too. Turn me down, and it's \$1000 a month you stand to lose."

Harry Krell laughed and microscopic pinpricks seemed to tickle every inch of Marvin's body. Beside Krell on the sofa, Karen's body quivered once. "We don't like each other," Krell said, "but we understand each other." There was something patronizing in his tone that grated on Marvin, an arrogant overconfidence that was somehow insulting. Well, the greedy swine would soon get his!

"Then it's a deal?"

"Sure," Krell said. "Come back to-

morrow with your clothes and a \$500 check that won't bounce. You get a cabin, three meals a day here in the house, free use of the sauna, the tennis courts, and the pool, at least two synesthesia groups a day, and whatever special events might go on. The horses are \$5 an hour extra."

"I'm paying for the two of us," Marvin said. "I should get some kind of discount."

Krell grinned. "You want to share a cabin with Karen, I'll knock \$250 a month off the bill," he said. There was something teasing in his voice.

Involuntarily, Marvin's eyes were drawn to Karen's. There was an emotional flash between them that brought back long-dead memories of what that kind of eye-contact had once meant, of what they had been together before it all fell apart. He found himself almost wishing he was what he pretended to be: a pilgrim seeking to clean the stale cobwebs out of his soul. He had the feeling that she just might agree to shack up with him. But the glow in her eyes was forced by desperate need. Los Angeles was full of faces like that, and the Harry Krells sucked them dry and let them shrivel like old prunes when the money ran out. He had to admit that his body still felt something for Karen's, but he was long past the point where he'd let sex drag him where his head did not want to be; the going up was just not worth the coming down.

"Pass," he said. Karen's expression did not change at all.

Krell shrugged, got up, and walked out onto the porch in that strange uncertain gait of his, inhaling sharply as he crossed the shadow-line into sunlight.

"I know you're up to something cheap and tricky," Karen said.

"Then why did you agree to warm Krell up for me?"

"You wouldn't believe me."

"Try me."

She sighed. "Because I still care a little for you, Bill," she said. "You're so frozen, so tied up in knots inside, and who should know what that's like better than me. Harry has what you need. Once you've been here a while, you'll see that, and it won't matter why you originally came."

"Saving your alimony had nothing to do with it, of course."

"Not really," she said. *And as the words emerged from her mouth, they became brightly-colored tropical butterflies, and she became a lush greenness from which they flew. There was a soft musical trilling, and the smell of lilacs and orchids*

filled the air. In that moment, he felt a pang of regret for what he had said, saw the feeling she still bore for him, heard the simple clarity of her body's animal love.

In the next moment, they were staring at each other, and tension hung in the air between them. Karen broke it with a small, smug madonna-smile. Marvin found himself sweating at the palms, and somewhat leary of what he was getting himself into.

The cabin was sure a dump for \$500 a month: a bed, a dresser, a couch, a bathroom, two electric heaters, and a noisy old motel-type air conditioner. Breakfast had been granola (69¢ a pound), milk and coffee, and Marvin figured that Krell would use the same health food excuse to dish out cheap dinners and lunches. The only thing that required expensive upkeep was the riding stable, and that ran at a profit as a separate operation. Krell must be pocketing something like half the residency fee as clear profit. Fifteen cabins, some of them double-occupancy... that would be seven grand a month at least!

There's no business like the guru business, Marvin thought as he followed Krell and three of his fellow residents out onto the porch above the rumbling sea.

Four large plush cushions had been placed on the bare wood in a circle around an even larger zebra-striped pillow. Krell, in his white sarong, lowered himself to the central position in a semblance of the lotus position, looking like the Maharishi as played by a decaying Tab Hunter. Marvin and the other three residents dropped to their cushions in imitation of Krell. On Marvin's left was Tish Connally, a well-preserved 35ish ex-Las Vegas "showgirl" who had managed to hold on to a decent portion of the drunk money that had swirled around her for ten years, and who had eyed him a couple of times over the granola. On his right, Mike Warren, the longhair he had seen the first day, who turned out to be an ex-speedfreak guitarist, and on the far cushion, a balding tv producer named Marty Klein, whose last two series had been cancelled after thirteen weeks each.

"Okay," said Krell, "you all know Bill Marvin, so I guess we're ready to charge up for the morning. Bill, what this is all about is that I unfreeze everybody's senses together for a bit, and then you'll have synesthetic flashes on your own off it for a few hours. The more of these sessions you have, the longer your own

free-flashing will last, and finally our senses will be re-educated enough so you won't need me."

"How many people have... ah, graduated so far?" Marvin asked sweetly.

To his credit, Krell managed not to crack a scowl. "No one's felt they've gotten all I've got to give them yet," he said. "But some are far along the way. Okay, are we ready now?"

The morning sun had just about burned away most of the early coastal fog, but traces of mist still lingered around the porch, freshened by the spray churned up by the ocean as it broke against the rocks below. "Here we go," said Harry Krell.

There was light: a soft, all-enveloping radiance that passed from sunshine yellow to sea green with the tidal rhythm of breakers crashing against a rocky shore. Marvin tasted a salty tang, now minty-cool, now chowder-hot. To his right, he heard a thin, throbbing, blues-like chord, something like a keening amplified guitar stretching and clawing for some spiritual stratosphere, higher, higher, higher, but never quite getting there, never resolving the dynamic discord into a bearable harmony. To his left, a sound like the easy ricky-tick of a funky old piano that had been out of tune for ten years, and had mellowed into that strange old groove. Across from him, a frantic syncopated ticking, like a time-bomb running down as it was running out, a toss-up as to whether entropy would outrace the explosion.

And dominating it all, the central theme: a surging, blaring, brassy wailing that seemed a shell of plastic around a central motif of sadness—a gypsy violinist playing hot jazz on a tuba—that Marvin knew was Harry Krell.


Marvin was knocked back on his mental heels by the flood of transmogrified emotions pouring in on him from unexpected sensual directions. He sensed that in some way, Mike Warren was that screaming non-chord that was the aural transformation of his visual persona, that Tish Connally was the funky ricky-tick, and Klein's running-down rhythm, a has-been wondering whether he would fall apart or freak out first. And Krell, phony brass within sad confusion within cheap pseudo-sincerity within mournful regret within inner emptiness like a Muzak version of himself—a man whose existence was in the unresolvable tension between his grubby phoniness and the overwhelming rich strangeness of the unique consciousness a random hit on the head had given him, grandeur poured by fate
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Water supply and Winter Olympics
site all in one, and in California?
Why not?

THE NEXT DROP YOU DRINK

article/James Sutherland



They begin arriving long before daybreak in an endless procession of station wagons, campers, sports cars and motley old converted school buses. The narrow, dark Pacific Coast Highway is jammed with thousands of vehicles, each frantically jockeying for a parking place. By sunrise the Highway south of Los Angeles is parked solid with cars, all the way from the low seaside cliffs around Long Beach to the yacht basin at Balboa.

The cars stand deserted in the gathering light. Everyone expectantly faces the ocean, eyes straining at the horizon, to where the silhouette of an island lies

art/Monte Rogers

crouching in the fog. Certainly it utterly nondescript appearance scarcely seems to warrant this amount of attention. Like so many other islands off the coast of Southern California it looks singularly lifeless, rumpled and forlorn. No matter. After a few minutes, even the most casual observer catches on: this island is moving!

Moments later, as the full light of dawn at last appears, the island undergoes a startling transformation. The sea mist clears from around its bulk, it changes color from a deep solid grey to glittering blue-white and distinctive features leap into view, wide crevasses and spiky peaks that thrust high above the oily sea. Finally there are the half-dozen huge ocean-going tugs, straining at their tow ropes to haul this behemoth into position.

The next events follow quickly. The tugs drag the floating mass to windward and let go the sea anchors. Then the permanent grappling anchors are attached and dropped to catch on the ocean floor. Mooring complete, the tug flotilla backs off, their part in this operation completed. After a hundred and sixty days at sea in transit from the Antarctic icefields in the Ross Sea to the Long Beach Channel, this month's iceberg is now ready to be melted down into pure fresh water and piped to the parched cities and farms of the Southwest.

Drought-inspired wet dream? A hydrologist's fairy tale? The last scene from *The Iceberg Cometh*?

Actually, none of the above. It was simply a projection of the latest stage of a plan first proposed by Professor John Issacs of the Scripps Institute of Oceanography in the mid-1960s. Issacs estimated an iceberg eight hundred feet long, towed by a pair of war-surplus battleships from the Antarctic to San Diego, could furnish the city with over three billion gallons of fresh water. Essentially the same concept has been approved by the Chilean government to supply the water-starved port of Antofagasta in the near future, and recently several County of Los Angeles officials expressed interest in a broader application of Issac's original plan: a monthly relay of forty-mile long ice blocks.

When melted these monsters would release hundreds of billions of gallons annually, but such is the magnitude of the Southwest's needs that even this would be insufficient. Rather, it would barely keep pace with the spiraling demands for more fresh water.

And the problem can hardly be described as a local or even a regional condition, for the United States, along with virtually the rest of the world, is rapidly approaching a great water shortage brought on primarily by the spread of mechanized civilization over the entire planet.

Agriculture, for instance, was once confined to the valleys and plains where natural fresh water supplies were adequate. Now, with the advent of high-yield, high-density crops grown in remote semi-arid uplands and deserts, irrigation is absolutely vital; and the irrigation water must be piped from afar, often hundreds of miles. With population expanding unchecked, experts forewarn that double the present food supply, and twice as much water, will be required to feed the new billions born by the end of this century. Heavy industry, the base of modern civilization, is a voracious consumer of existing water supplies, too: 90% of the river and stream water used by industry is not reused beyond the initial manufacturing processes. One hundred thousand gallons are used up making a ton of paper or steel, a half-ton of gasoline, or a quarter-ton of plastic. A million gallons a week may be needed to cool the red-hot core of a nuclear power generator. Personal use of water, in pools and air conditioners and plumbing, is rising fastest. Each American uses fifty-five gallons daily in various ways; by 2000 it will be up around two hundred gallons.

The obvious need for more water is prompting a world-wide hunt for new sources of water. What's wrong with the traditional, familiar means of securing fresh water? They can't meet the need. Drilling, draining and piping-off of rivers and streams has nearly exhausted the natural supplies. More dry wells are sunk every year, and more are encountering brine contamination, while the network of streams and rivers is depleted severely in most of the country. Pollution also is further diminishing the supply of fresh water by rendering the waters unfit for life, such as Lake Erie and the Cayahoga and Hudson Rivers.

The need for new water sources is most critical in those areas men previously considered unfit for habitation, but which now must be lived in, due to the pressures of population. The expanses of waterless mountain, plateau and desert which were passed over by previous generations, are now considered the new frontiers for settlement. Enormous arid chunks of wilderness in the American Southwest, the Middle



East and Africa are being thrown open to settlers and developers without much thought to where the water for all these people is coming from. Without the water there will be no new towns—or even people at all. So water, or the lack of it, is shaping up as a major breeding ground for tension, disagreement—even war. When there's too little to go around, reason and co-operation go out the window: it's every man to guard, or capture,



An eight-hundred-foot-long iceberg from a field such as this, towed to a population center in North America could, even after partial melting during the trip, provide some three billion gallons of water.

whatever he can. "In the desert," wrote Loren Eiseley, "the voices of God and the Devil are scarcely distinguishable."

At first glance, the notion that water, just water, can arouse such passions, seems faintly ridiculous. What could be more prosaic than a glass of water? Even the chemical formula is monotonously familiar. H_2O . Two atoms of Hydrogen to one of Oxygen. But it

is on this basic level that man's sometimes paradoxical relationship with water begins.

The water molecule, by virtue of its so-called "Hydrogen bond," is the closest thing to a universal solvent yet encountered, and so it is central in the life processes which involve the constant breaking-down of substances and their transport through the cells of the body.

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Rogers



three tinks on the house

As we crowd each other more and more, more and more of our personal freedoms will have to go. Will we even realize they are gone, though? Will we even care when we become slaves to our own technology?



Four o'clock in the morning! Why do you have to work such crazy hours?" Stuffing the 30-hour week into three days cuts commuter traffic a lot, but it doesn't do much for my wife's disposition. "If I didn't have to ride in with you for this damned dentist's appointment . . ."

Normally, Linda's a good-looking woman—big green eyes, shiny black hair in a monkey-fur cut, skin holding up better than most. After eighteen years of marriage I still like to look at her, especially when she smiles. But when she's feeling hacked about something, she can look like a witch.

"More coffee?" I said, and poured for her. "Good breakfast, honey." I'd finished my egg, toast and juice, and was relaxing over coffee.

"Wouldn't be so bad, Johnny, if it didn't take so long to get to town."

"All right! Let's get out where there's room to breathe, you said. OK, here we are. Out of the high-rise jungle—no apartments over fourteen stories. Of course, they're *all* fourteen, but what the hell. Use of the pool Tuesday and Fridays if we want. Our own parking slot in the secured area. So it takes a little longer to get to work; you win some, you lose some."

"I suppose. If I just had my own car again . . ." She stopped, and smiled a little. Not much, but a little. Breakfast was beginning to help. "Look—I know it's not practical—the double tax on second cars, and all. It's only that I had a lot more fun when I had my own job and my own car."

"Sure, I know, Linda." A computer took her job and the Eco Laws took her car. I was glad she hadn't rubbed my nose in one bet I'd lost, when the first big Eco crunch had hit, the color-coded routes and the Federal horsepower tax, I'd had to sell the one car to pay for propane conversion on the newer one. I'd thought propane was a safe bet, and only forty cents per horse instead of the dollar for Diesel or gas-hogs. Not to mention the saving on fuel tax . . .

So what happened? The Enumclaw Freeway, my best route to Seattle, had been coded yellow—no internal combustion. Commuterwise, I was up the creek. But to convert to an outside-burner I'd have had to put a second mortgage on the apartment. Well, I'd taken the chance, and lost.

She made a grimace, a little one-sided



"He faked Anstruther's hands high and slammed him in the gut, then threw his hard one. Anstruther's head cracked back and he collapsed."

grin. "Maybe Metro Transit really will run the Renton line down here, complete the loop to Kent. They keep promising. You know, with all the taxes we pay..."

"Yeah. The taxes." I sipped the dregs and stood. "Ready?"

"Un momento. Better safe than sorry." She went into the bathroom.

I had to smile, remembering her story of the last time she'd stopped at a service station to exchange the left-hand propane tank for a full one. First there was a guy in the john who stayed a long time, and when he came out he let the door go locked. Any decent fellow would have held it for her, with the attendant not watching. Then it turned out she wasn't carrying that company's credit card, and the door scanner wasn't programmed to recognize her bank card. The station attendant couldn't be bothered to help.

"Unlock this Goddamned door," she'd said, "or I'll piddle right here in front of it!"

But he'd told her, "Go ahead, lady. The fifty bucks for littering, you can put on your bank card." There wasn't any other place handy, so she'd had to hold it until she got home.

On second thought, it wasn't funny. Those things used to be free, part of the service—not a gimmick to promote a company's own credit cards.

Linda was ready to go. I cut the alarms, checked the hallway and monitored for her to come out. I made sure to thumb the ten-second reset button before closing the door behind us. The building hadn't had a successful break-in during the four years we'd lived there, and only one killing and two rapes in the halls. But still I think it pays to stick to the routine.

We showed ID to the guard by the elevators, to the one in the elevator itself and at our parking sub-deck. The man on duty there handed me our car keys. As we walked away he was alerting the outside guard over the intercom.

The car was a '76 VW Matador, remodeled slightly for the propane. Even if I couldn't drive it on the yellow-coded freeway, I still liked it. For one thing, it covered only 75 square feet of ground space; the size kept my surcharge down to \$225. The Matador started on the first try; I drove slowly through the well-lighted aisles.

The inner doors were open. I drove through them into the security pocket, waited for them to close behind me and then for the outer gates to open. We were on our way. The smog wasn't at all bad; I could see the sun.

Old Route 516 was still coded blue, barred only to gasoline and Diesel. It was slow, a four-lane back road crowded with freeway-rejects like myself, but it was the best route available.

"Do you know if Marise came home last night, Linda?"

"No, I mean she didn't. She and Sydnie were going to stay with Ali and George." I felt relief—Marise and her girlfriend, at 17, were still satisfied with the young studs in our own safe building.

"Ali and George, again? She could do worse. Anything serious, do you think?" We were approaching the interchange to I-5 North; I switched lanes. By rights, I suppose, I-5 should be yellow. But it's the only good secondary route north into Seattle, so most of the time it stays blue. Luckily for me.

"Marise says she and Syd would like to try a four-marriage there for a while, if they could pry the two boys out of each others' arms long enough. Not for children, yet; you know Marise is in no hurry to make paternity choices."

I swung into the interchange and merged onto I-5 North. Not far ahead, I could see high-rise country looming. But my mind was on our kids.

"Yes, she'll be all right," I said. "George doesn't have much in the way of brains, but those four aren't likely to hurt each other much. And since the abortion, Marise gets her implants renewed, right on schedule. But..."

"It's Les that bothers you, isn't it?" I didn't answer immediately. I was trying to think it out—how I felt, and how much of what I felt was leftover from cultural conditioning.

We passed the first Sea-Tac exit. The old airport wouldn't handle anything bigger than a 747. But as long as the FAA still defined flight-paths in piston-engine terms, Sea-Tac held the high-rises at bay.

"Yeah, Les," I said, finally. "I'm not arguing against adolescent bisexuality—for one thing, it holds down the abortion rate. But when a fifteen-year-old boy can't see a girl at all, for his boy friend's ass, I think maybe the schools and the media are pushing it a little too much. When I was his age—"

High-rise country began, about where Boeing Field used to be. Not much diluted sunlight from there on—the tall boxes cut off all but an occasional shaft.

Linda laughed. "I know. When you were his age you were in love with the Playboy centerfold and got your sex in the bathroom with the door locked." She patted my thigh, high and inside; not

expecting the touch, I jumped a little. "But didn't you ever—"

"A little. Playing around, experimenting, I guess. But not much."

Billy Jordal and I, maybe twelve. Excited as hell from talking about how it would be with a girl. Trying some things that were as close as we could think of to the real bit. Not doing too well at them. Then, when somebody else got caught, not us, learning what other people called what we'd done, and what they thought of it. After that, Billy and I weren't friends anymore. We stayed away from each other. At least, I thought, Les wasn't getting loaded down with all that guilt crap.

Oh, Johnny—isn't that the tunnel exit? I'll look... no, no enforcement behind, that I can see."

The waterfront tunnel exit was a permanent gripe of mine. Naturally, the tunnel itself was coded red—no combustion cars. But the exit ramp went several hundred yards in open air to get to the tunnel, and halfway along it was a second exit that saved me twenty minutes of dumb stop-and-go traffic. Because some moron ran his red pencil further up his map than necessary, all the way to I-5, I was not supposed to use that shortcut.

I did, though, habitually—except when I spotted enforcement in position to see me. I'd caught three tickets in four years; I figured I was ahead of the game. But it still pissed me. I'd written a letter to the morning paper once. It wasn't printed.

I won again—no pursuing tweeter, no pulllover, no citation. But it still frosted me, having to take that chance for no good reason.

The thing is, I have better things to do with any twenty minutes of my life than to sit looking at red lights for no good reason.

We drove west along the south edge of downtown. White-coded, to my right—no private vehicles at all. I let Linda off near a Transit station, about a dozen blocks from my parking area. We kissed. I was glad I'd married a woman who didn't forget how. "You want to wait and ride home with me," I said, "or go earlier?"

"No," she shook her head. "I'll take Transit to Renton and chances from there." I knew what she meant. The electric buses were regular, but we lived two miles from the nearest. The free-lance jitneys were more flexible—if you could find one. Private cars would give

rides sometimes, but a woman couldn't be too careful. Or a man, either, for that matter. Linda has a good instinct for safety, though. She'd had only one bad scare—a freak in a Rotarian suit; they'll fool you—and she'd gotten out of that one OK.

As soon as she entered the station, I drove on. The parking area at work handles eight or ten plants and hasn't enough security to plug your nosebleed. We get by because everybody knows there's nothing much to steal or mug in an industrial parking lot, outside of the Executive Section. There are a lot of raps, though, mostly by employees. No security system can prevent all of those.

I got lucky, and parked only about half a mile from the plant. I decided the hell with the respirator; even down in industrial territory the smog was light. I brought it along, though; the afternoon could be different. The shuttle wasn't in sight or hearing, but the walk was good exercise; I could use it.

I found the office shorthanded. That's par when it's not our regular workday, when we're shifted so that the high-pollution plants can operate on a low-smog day. It happens so irregularly that routine-bound types aren't braced for it and are apt to miss work.

Ten hours makes a long day; everyone gets irritable. Franzen over in Expediting tried to bend me once too often. I told him to freak out; it was time he knew I don't work for him. I came close to asking him to sign waivers with me and have it out: any limits he wanted, or none. He's big, all right, but not that big.

Being still chugged at Franzen was my only excuse, if any, for bumming Leda Robarge when she came around at the afternoon break. I knew her trick; everybody did, around there. Why she doesn't find a new hunting ground, I'll never know.

I have nothing against a little healthy seduction, or most forms of sexual freedom, in moderation. Linda and I will swing a little with good friends and don't begrudge each other an occasional night out. The time we tried a four-marriage, it broke up over such things as garlic and wet towels. But Leda's scene was not healthy.

She'd collected for help on two abortions—"my doctor has no *idea* how it could have happened"—before a third guy checked and found she'd drawn her Federal sterilization bonus when she was twenty.

My problem was that my skull was running at half-speed, same as the air-

conditioning. When she began to put it on me, fluttering her eyelids to emphasize the fashionable gold foil that covered them, I said, "Leda, I expect you're one hell of a good spread. But we have to think of the future."

"The future, Johnny? Why, I don't know what you mean."

"Well, if anything should go wrong—if you were to, say, get pregnant—don't worry about a thing, Leda. I'll have the baby for you."

She threw a mean coffee cup, but her aim was off. I felt a little guilty, but not much. People Pollution is bad enough; people who try to collect on it are even worse.

That day couldn't end too soon, and it didn't. Trudging back to the car, I knew I'd been someplace. The smog was high; I should have used the respirator, but I was too pooped to bother.

And GodDAMN! Not thinking, I'd driven the little Matador all the way into the parking stall, leaving room for some ass to sneak a Midgie in behind me, crosswise inside the spotter beam, blocking me. *You sonofasow!*

Midgie had chosen badly; I carry a dolly-jack in the rear-hood. Up and out with the heavy thing, under the braked back wheels; raise it. Fine. Now, where to put it?

Franzen's stall was close; I was tempted to dump it on him. He's a mechanical moron; he'd probably try to kick it to death. But I settled for leaving the Midgie directly in the spotter-beam at the back of an empty stall. Not unhappy. I drove away. Midgie would probably pay about fifty for that one. *That'll teach you to screw around with the Green Hornet!*

A few blocks ahead of the on-ramp to I-5 South, I saw the blinker signals. Access had been cut from blue to yellow: external-combustion, yes; me and my propane, no. For a while, until the smog level dropped and the signal changed back again, I was stuck.

I could cut over to old Route 99, like crawling on hands and knees. Or I could wait for I-5 South to shift back to blue. If it shifted within the hour, I was better off to wait. And more comfortable . . .

Yeh. Joe's Stoneboat Bar was off to the right, not far. I stopped there sometimes, knew a few of the people. For instance, one of the doctors from the nearby hospital was an engraved character.

I turned right, and three blocks later pulled the Matador into the shady side of Joe's parking lot. I hated to button up the car, in the heat.

The Stoneboat was cool inside. The back room, away from the TV-juke, was quiet except for the crowd noise. I figure that's why Joe usually works that room himself and lets his hired help handle the front.

"A live one, Johnny?" said Joe. I nodded. Live-yeast beer is my favorite low-high; sometimes I wonder how we ever got along without it.

Even after three years a bar doesn't smell right to me without stale cigarette smoke; the Stoneboat smelled only of beer and last month's repainting.

I knew the two men at the table next to the end of the bar. We said "Hi" and I sat with them.

Artie Rail was singing it down about his stupid car some more. "I just dunno what I'm going to do, fellas." He said it with his usual whine. "I'm about ready to turn it in for the demolition bonus. Except I can't afford to buy anything I can afford—if you see what I mean."

Sure, I saw what he meant. Artie was paying three-four hundred in horsepower tax, and close to the same for the area of his Detroit parade-float. He was in a tight knot, all right.

Hollis MacIlwain wasn't wasting his sympathy, if he had any. "Oh hell, Artie, it's your own fault. You bought that Cadillac when the taxes you bitch about were already in the talk stage. It was a damn fool trick, and you know it."

"Yeh?" Artie bit back. "You weren't all that happy, Hollis, when you had to put in short pistons, to cut your compression for no-lead gas. Anyway, my brother-in-law gave me a real good deal on that Cad."

"So sue your brother-in-law." Hollis' gravel voice was weary. "Don't load me with your grotchies."

I wasn't much interested, either; I'd heard it all before. We'd each had to make our choices. I'd made my bet two years ago, good or not, and got it over with. But here they were, still at it.

"What ya think's the best pick in the new stuff coming out?" Artie said. "Joe, you got any upper ideas on that?"

"Hard to tell. General Ford's selling its little electrics a lot, for short-haul. The ones with the plug-in packs."

"Yeah," I said, "but you use twenty percent of the charge just lugging the pack around. OK if you don't use a car much, I guess."

"Hey, Joe," said Hollis, "gimme a tink-and-tonic." He had bills on the table, and his card for Joe to punch. "You know what I think?" We did, but he went ahead with it anyway.

"Until somebody without an expense



"Marise says she and Syd would like to try a four-marriage there for a while . . . but not for children, yet; Marise is in no hurry to make paternity choices."

account can afford one of those fuel-cell jobbies, you're not going to beat the little Japanese outside-burners, like the hot-air Honda my nephew got." He went on with it, but I wasn't listening. He always says it just about the same, Hollis does, as if it was real news.

A new customer came in, a young fat little guy, letting the TV-juke noise come with him as he opened the door. It was the *Stucco Crocodile*, doing "Baby, You're a Sidewiser." I didn't notice anyone inviting him, but he came and sat with us, anyway.

The three of us gave each other the look that said that none of us knew him. The Stoneboat got trade from people hanging around the hospital waiting-rooms up the next block. Usually, though, they stayed in the front room with the juke to take their minds off their worries.

"Tink and soda," the new guy said. Joe waited until the man remembered and got his card out, to go with his money. "It's all right, bartender. First one today." So Joe punched the card, counted the drops of tincture he shook into the glass, and added the ice and soda. The man didn't get the extra drop, I noticed, that Joe usually gave his regular customers, law or no law. His first sip went long and deep; he grimaced at the bitterness. Personally I like a mix that covers the taste.

"Aah! That's what I needed." He smiled, then apparently thought better of it. "Oh, bartender! I'm expecting a call. From the hospital. They'll ask for Mr. Anstruther. If you don't mind."

"Sure," said Joe, "no trouble. Bleeding for some news?"

"Yes," Anstruther looked embarrassed. "My wife is—er, having a baby."

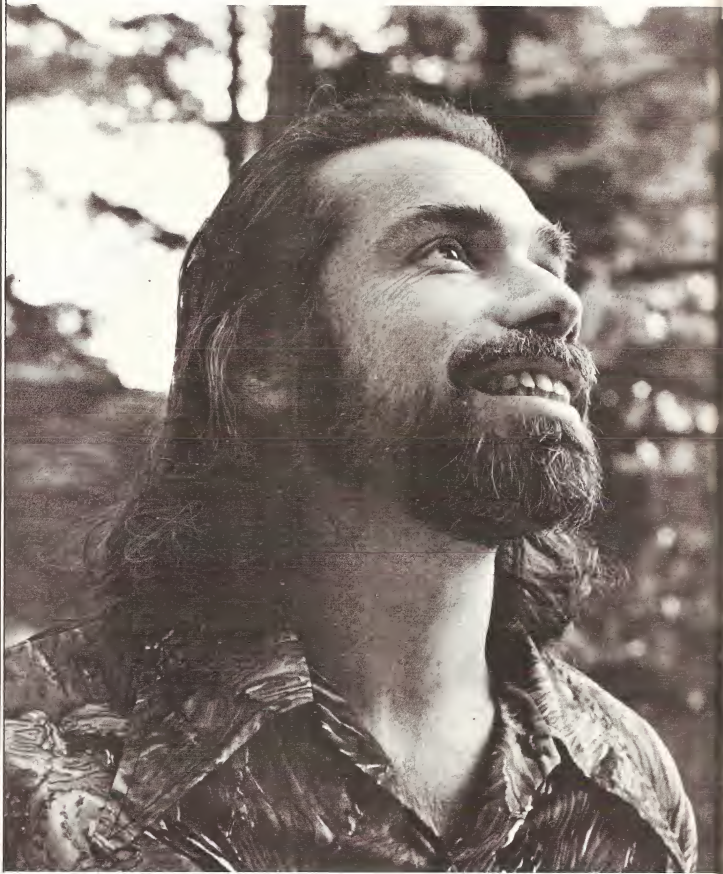
We were all careful not to look at him. Then I thought, what the hell; it happens sometimes. And he was pretty young; maybe it was his first. Couldn't blame a man for that, even now. I had two myself, but they dated from the 1960's, when nobody knew any better. Now, there wasn't that excuse.

More to break the silence than anything else, I said, "Hey, Joe! Throw a tink in a live one for me, will you?" That's the way I like tink; I can't taste it through live beer. Joe inspected the card with a straight face before he punched it—I mean, he knows I seldom tink up and hardly ever take the limit of three in one day.

He gave me the extra drop for being a regular, though. Someday, I thought, he's going to get narked off for that. I

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Robert Silverberg is the author of over 100 science fiction books as well as being one of the top S-F anthologists and popular science writers.





AN INTERVIEW WITH ROBERT SILVERBERG

interviewer/ Paul Turner

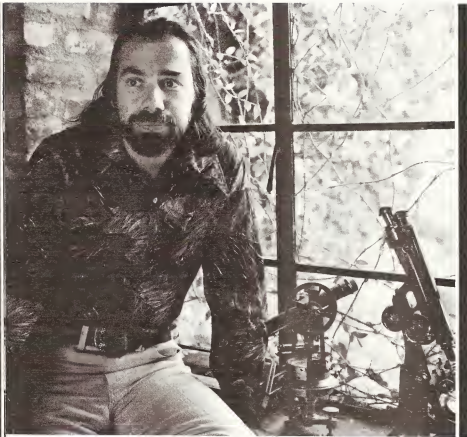
VERTEX: Would you please tell us how you came to start writing science fiction?

SILVERBERG: Well, I'm a science fiction reader, which I think is the usual practice among SF writers, who were in it as readers before they turned to writing it. Somewhere in my teens I tried to imitate that which I liked, found I was fairly good at imitating the many forms, gradually moved from imitation to creation on my own, and suddenly I was a SF writer.

VERTEX: What attracted you to science fiction in the beginning?

SILVERBERG: The visionary aspect of it. The portrayal of scenes beyond my immediate grasp. I was, and still am, a person of great curiosity, and I wanted to know what the year 2,000—or 20 million—would be like. There was no way I was going to see those wonders, and SF offered the only substitute for immortality. It's a time machine for me, and always has been. The kind of SF I liked best, as a reader, was the visionary fiction. Not something that foretold the development of a new kind of storage battery three years from now, but the kind that would reveal to me an

“Science fiction is life, infinity, opening, eternity, the whole cosmos. Naturally, if you’re 15 or 17 years old and the world is fresh and clean before you, you’re going to turn to this life-enhancing, mind-expanding kind of fiction.”



"... the Odyssey was the first S-F novel, with the world populated by strange visionary scenes and unlikely creatures, and it hasn't lost its appeal in all those years since Homer. I think the basic thing of opening up new vistas will always have appeal."

entire society, or an entire world of rich and strange structure. In a way I was piggybacking other men's minds to live their fantasies. Then I began to create my own.

VERTEX: So you were influenced by other men's ideas. Do you feel your writings have influenced the development of our culture?

SILVERBERG: Oh, I don't know. That sounds very solemn to me.

VERTEX: Well, let me amend that. Do you think science fiction has influenced the development of our culture?

SILVERBERG: I think that, in a limited way, science fiction has created an openness, an adaptability, to strangeness, to strange forms and textures of life and, particularly in the last five years, when American life has grown so strange and different, the presence of science fiction has been a precipitating factor. But that is all just cosmetic. I don't really think that SF has fundamentally changed anything. I don't think pictures have changed anything, or music, or sculpture. SF has had its effect on music, dress, hairstyles, things like that, but not on basic attitudes. I don't mean to put SF

down. I just don't believe an art form can have that much influence.

VERTEX: What about science fiction in general. How does it differ, in your mind, from mainstream?

SILVERBERG: The difference, to me, is one of content rather than one of form. It deals with that which is not here and now. It shows wonders. Mainstream fiction can also show wonders, but it's like the wonders of the Sierra Nevada or a suburban real estate development. The material of SF is what defies imagination. It's infinity. Last night I happened to be at a gathering of writers, mostly mystery story writers, and one was talking to me about the appeal that SF suddenly seems to have for younger readers, whereas mystery doesn't seem to have that appeal. Of course, there's a strong, dedicated readership, but it doesn't light up the young as SF does. He asked me if I believed this was true, and I said yes. He asked why, and I told him, as gently as I could, that his business is death, while mine is life, infinity, opening, eternity, the whole cosmos. Naturally, if you're 15 or 17 years old and the world is fresh and clean before you, you're going to turn to the life-enhancing, mind-expanding kind of thing more readily than to fiction which has to do with the most debased and brutal act one human being can commit against another. He thought that over, not particularly hurt by it, then said "yeah, that's about it." I see SF as the epitome of life, even at its most negative.

VERTEX: Do you see SF continuing into the future?

SILVERBERG: I hope so. It's been with us now, I'd say, for 3,000 years—perhaps the Odyssey is the first SF novel, with a world populated by strange visionary scenes and unlikely creatures, and it hasn't lost its appeal in all those years since Homer. I think the basic thing of opening up new vistas will always have appeal.

VERTEX: Now that we've gone to the moon and done many other things which were SF just a short time ago, what areas do you see ahead for SF to explore in the next 20 or 30 years?

SILVERBERG: I really think we'll be going back over many of the basic themes of SF and exploring them with greater intensity. After all, H.G. Wells did the time travel story, the invader from another world, the mutant story, and yet he didn't exhaust those themes, although he handled them

magnificently. I think we still find new ways of entering these themes, and I think we may see less about the details of exploring and more about the exploration of the human psyche, the soul, the relationship of man to the universe. Big themes which SF is perhaps better equipped to handle than any other form of writing.

VERTEX: That sounds almost spiritual. Do you have that feeling about SF?

SILVERBERG: Well, in my more romantic moments, yes. A lot of SF is merely commercial formula stuff. Well, a lot of anything is. I think SF, as its highest, can be very high.

VERTEX: There seems to be a new direction in SF now. The old SF hasn't died, the nuts and bolts type, but there are writers going off in new ways. What school do you subscribe to?

SILVERBERG: Well, not really any school in that sense. I like to think I'm my own man. But in the larger world of SF there have been changes. There is a richer texture, density of prose, stylistic developments; which have come in the wake of James Joyce and the other great writers of the Twenties. In SF we have belatedly had an influx of writers whose basic literary grounding has been not so much in the SF novels as in classic novels. That is, instead of being raised on Heinlein and Asimov, they were raised on Faulkner and Joyce, and then drawn to SF themes. This is the trend in SF in the last 10-15 years.

VERTEX: There seems to be a new wave of SF that concerns itself principally with feelings, emotions, and not so much with science. What do you feel about this?

SILVERBERG: For me, the new wave is stylistic. I've been associated with it myself, and I believe it's not a matter of content so much as approach and execution. There are those who say that new wave writers are anti-science, anti-technology, their stuff is defeatist—some of it is, but basically I think science is as important as ever to SF, in that a knowledge of the way the universe works is important to any SF writer. The more he knows about it, the better his fiction. I wouldn't turn my back on the latest developments of quantum physics, insofar as I can follow them, although many times they're submerged deep in the story or not there at all because they're not that important to that particular story. I don't want to talk

about the new wave as a school, because I don't think it is. Just a group of energetic young writers who came into SF and are trying their best to break down the existing boundaries. VERTEX: How do you go about writing? People always seem interested in the way authors get ideas, and they each seem to have their own methods. What are yours?

SILVERBERG: Ideas just come. I don't force them, and somehow they come. You know the story of the centipede who was asked how many legs he had. He didn't know, and started counting, moving along, counting the legs on one side, lost count after a while, started counting on the other side, matching up pairs, etc., and in the course of it got so tangled up in his legs that he couldn't walk at all. Well, I do not look very closely at the sources of my creativity for fear of ending up like the centipede. The ideas come, and when they do I usually write them down on the handiest scrap of paper. Then begins the process of manipulation. Basically that's taking the hands, the *manos* as we say in Latin, and smooching things around. So, with a pencil, I manipulate or shape these ideas until a firm beginning, middle and end comes out of it. Once I have that, it's usually sufficient for me to do an outline, which is enough for me to begin a novel. I know the voyage, then, and how I'm going to get there, though I may not know how it's going to be along the way.

VERTEX: Are there any special conditions you require to do this?

SILVERBERG: Well, being distracted doesn't do my writing any good. I've always had a room apart from the household chaos where I could be alone. I usually answer the phone when it rings, being glad for the break, but it doesn't help anything. I work a very rigid schedule. These days I work Monday through Friday, from 9 a.m. to noon. It used to be I'd work in the afternoon, too, but now I try to do less writing, more reading, traveling, living. I get into the rhythm of daily production, whatever it is, 2 or 3 pages a day, and by working steadily, day after day, week after week, words pile up. If you do 3 pages a day, that's 15 pages a week, and in 12-15 weeks you have a novel. That's always been my system.

VERTEX: How many books have you written?

SILVERBERG: I don't know. It's a

great many. Over one-hundred. Of course, I've been a professional writer since 1953—almost 20 years. These days I write much less because I revise so much, but there was a time when I could write 6 or 8 books a year. I keep many statistics on my work, but the number of books I have done isn't one of them.

VERTEX: You've written other than SF, haven't you?

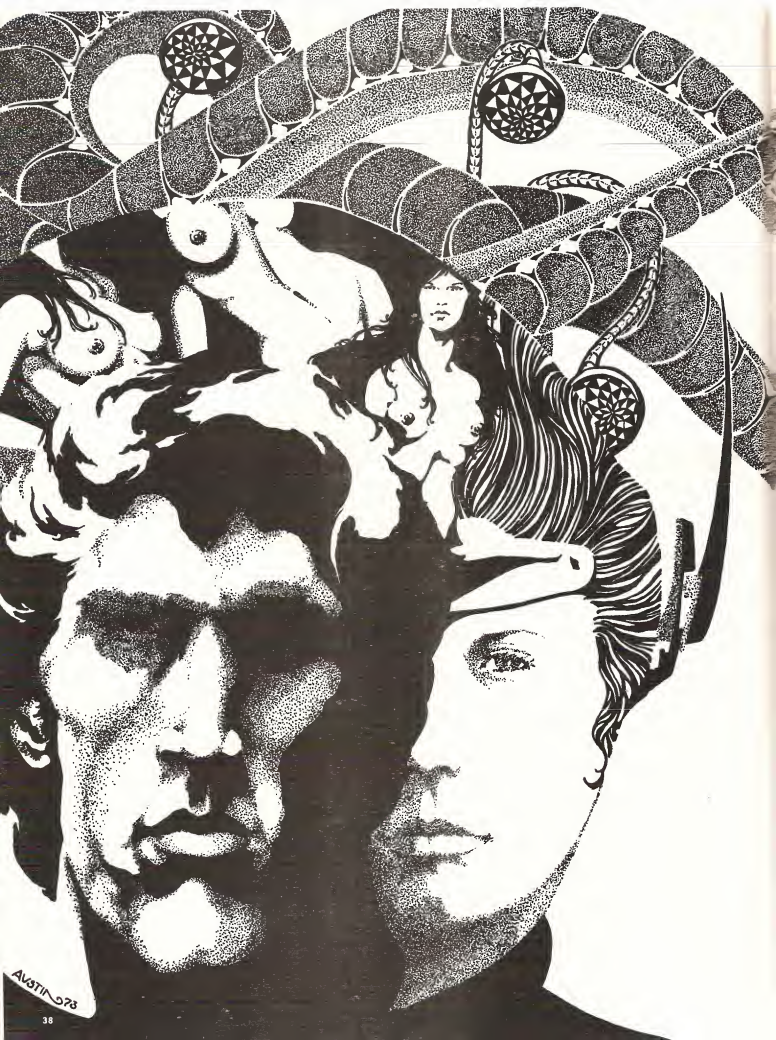
SILVERBERG: For a long time I wrote popular nonfiction. Books which were a synthesis of scholarly works, generally in the archeological, historical and scientific areas. I thought of those in much the same way as I did about SF—in terms of what they did for me. A book about a civilization that vanished 5,000 years ago served as a reference for me on a book about a civilization which might exist 5,000 years from now. I did 3 books which I think were useful and important syntheses of subjects that hadn't been drawn together before, particularly the book I did on the mound builders of the U.S. midwest; an American Indian civilization that had become encrusted by legend and fantasy. I took a look at the fantasy. The book was called *The Archeology of a Myth: Mound Builders of Ancient America*. Another was the legend of Prester John, the fabulous Christian monarch of Asia. Before these, at the very beginning of my career when I was pressed to earn a living, I wrote books of various other sorts.

Mysteries, westerns; but my heart wasn't in it and I dropped that as soon as I could.

VERTEX: What directions do you see yourself going in the future?

SILVERBERG: The direction I seem to be traveling in is towards experimental prose. I don't mean in the *Finnegan's Wake* sense, but I search for new ways of telling stories in structure. I've become almost morbidly preoccupied in perfection, sentences, etc. I think I work harder and harder to produce less and less. I will continue to write SF. Much of the SF I've been writing has been a kind of anti-science fiction. I don't mean negative science fiction, but a kind of anti-matter, the reverse of SF. I've taken SF themes, turned them upside-down, played with them. The story I did that won the writers award last year about the robot who is elected Pope is an example of that. It's a playful kind of fiction, not at all

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AVSTIN 973



Once again the BEM's had captured the lovely Aula, and Crash had to find her!

CRASH CAMERON AND THE SLIME BEAST

When Crash Cameron, Trouble-Shooter of Tomorrow, got back to the rocketship *Space Gas* with his prize—a fist-sized chunk of Unrealium XZ, the precious radioactive substance with which he had intended to recharge his craft's depleted energo-battery cells—his keen mind quickly sensed that something was amiss. The airlock doors were standing open. Pools of foul-smelling grey slime covered the ground around the spaceship and were to be found throughout the interior of the

vessel. And Aula was missing.

All of the evidence could lead to but one chilling conclusion, Crash realized, his steely grey eyes flashing. Aula had once again been carried off by some sort of bug-eyed monster!

The Earthman sighed resignedly. Aula's talent for getting snatched was positively uncanny: no matter where they went or what they did, he was always having to drop everything at least once per adventure just to go rescue the girl from one or more of the invariably hostile and inexplicably lustful monsters

of outer space. Aula could be a genuine pain in the main stern propulsion tube at times, Crash thought with a flash of bitterness. She was always loudly insisting that he never paid enough attention to her, always distracting him as he piloted the *Space Gas* through the ether between planets, always letting fly with fresh denunciations whenever he would patiently try to explain that there was no room in his life for mushy stuff so long as there was still the battle against Evil and Injustice to be waged. But he

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alibi machine

*fiction/ Larry Niven
art/ Monte Rogers*

*Instantaneous matter transport
will change our world to a
fantastic degree, but it will
have little effect on the age
old desire for material gain,
or the violence that often
grows out of that desire.*



"The GyroJet: An ancient toy or weapon, depending. It was a rocket pistol, made during the 1960's, then discontinued, and how could any former Buck Rogers fan have turned down a rocket pistol?"



McAllister left the party around eight o'clock.

"Out of tobacco," he told his host apologetically. The police, if they got that far, would discover that that had been a little white lie. There were other parties in Greenwich Village on a Saturday night, and he would be attending one in about—he estimated—twenty minutes.

He took the elevator down. There was a displacement booth in the lobby. He dropped a coin in the slot, smiling fleetingly at himself—he had almost forgotten to take coins—and dialed. A moment later he was outside his own penthouse door in Queens.

He had saved himself the time to let himself in by leaving his briefcase under a potted plant earlier this evening. He tipped the pot, picked up the briefcase

and stepped back into the booth. His conservative paper business suit made him look as if he had just come from work, and the briefcase completed the picture nicely.

He dialed three times. The first number took him to Kennedy International. The second to Los Angeles International. Long distance flicks required the additional equipment available only at what had once been airports: equipment to compensate for the difference in rotational velocity between different points on the Earth. The third number took him to Jacob Anderson's home in the high Sierras.

It was five o'clock here, and the summer sun was still high. McAllister found himself gasping as he left the booth. Why would Anderson want to live at eight thousand feet?

For the view, he supposed; and because Anderson, a freelance writer, did not have to leave his home as often as normal people did. But there was also his love of privacy . . . and distrust of people.

He rang the bell.

Anderson's look was more surprised than welcoming. "It was tomorrow. After lunch, remember?"

"I know, but—" McAllister hefted the briefcase. "Your royalty accounts arrived this afternoon. A day earlier than we expected. I got to thinking, why not have it out now? Why let you go on thinking you've been cheated a day longer than—"

"Uh huh." Anderson had an imposing scowl. He gave no indication that he was ready to change his mind—and McAllister had nothing to change it with anyway. Publishing companies had always fudged a little on their royalty statements. Sometimes they took a bit too much, and then a writer might rear back on his hind legs and demand an audit.

The difference here was that Brace Books didn't know what McAllister had been doing with Lucas Anderson's accounts.

"Let's just go over these papers," he said with a trace of impatience.

Anderson nodded without enthusiasm, and stepped back, inviting him in.

Did he have company? A glance into the dining nook told McAllister that he did not. A dinner setting for one, laid out with mathematical precision by one or another of Anderson's machines. Anderson's house was a display case of labor saving devices.

How to get him into the living room? But Anderson was leading him there. It was not a big house, and a hostile publisher's assistant would not be invited into the semi-sacred writing room.

Anderson stopped in the middle of the room. "Spread it on the coffee table."

McAllister circled Anderson as he reached into the briefcase. His fingers brushed papers, and then the GyroJet, and suddenly his pulse was thundering in his ears. He was afraid.

He'd spent considerable time plotting this. He'd even typed outlines, as for a mystery novel, and burned them afterward. He could produce the royalty statements; they were there in his briefcase, though they would not stand up. Or . . . His hand, unseen within the briefcase, clenched into a fist.

He was between Anderson and the picture window when he produced the GyroJet.

The GyroJet: an ancient toy or weapon, depending. It was a rocket pistol, made during the 1960's, then discontinued. This one had been stolen from someone's house and later sold to McAllister, secretly, a full twelve years ago.

A rocket pistol. How could any former Buck Rogers fan have turned down a rocket pistol? He had never shown it to anyone. He had had the thought, even then, that it would be untraceable should he ever want to kill somebody.

The true weapon was the rocket slug. The gun looked like a toy; flimsy aluminum, perforated down the barrel. Anderson might have thought it was a toy . . . but Anderson was bright. He got the point immediately. He turned to run.

McAllister shot him twice in the back.

He left by the front door. He grinned as he passed the displacement booth. Fifteen years ago there had been people who put their displacement booths inside, in the living room, say. But it made burglaries much too easy.

The alibi machine, the newspapers had called it then. They still did. The advent of the displacement booths had produced one hell of a crime wave. When a man in, say, Hawaii could commit murder in Chicago and be back in the time it would take him to visit the men's room, it did make things a bit difficult for the police. McAllister himself would be at a party in New York ten minutes from now. But first . . .

He walked around to the back of the house and stood a moment, looking into the picture window.

He'd thrown a paper tablecloth over Anderson's body. Glass particles on the body would be a giveaway. He'd take the tablecloth with him; and how were the police to know that it was the third bullet, rather than the first, that had shattered the picture window? But if it was the first bullet, then the killer must have been someone Anderson would not let into the house.

McAllister fired into the picture window.

Glass showered inward. There was the scream of an alarm.

McAllister stood rooted. It was a terrible sound, and in these quiet hills it would carry forever! He hadn't expected alarms. There must be a secondary system, continually in operation—Hell with it. McAllister ran into the house, picked up the tablecloth and ran out. Glass particles all over his shoes. Never mind. His shoes and everything else he was

wearing were paper, and there was a change of clothing in the briefcase. He'd dump gun and all at the next number he dialed.

The altitude was getting to him. He was panting like a bloodhound when he closed the booth door and dialed. Los Angeles International, then a lakeside resort in New Mexico. The police could hardly search every lake in the country.

Nothing happened.

He dialed again. And again, while the alarm screamed to the hills, *Help! I am being robbed*. When his hand was shaking too badly to dial, he backed out of the glass door and stood looking at the booth.

This hadn't been in any of the outlines.

The booth wouldn't let him out. In all this vastness he was locked in, locked in with the body.

It was two hours before the helicopter from Fresno arrived. Even so, they made good speed. Only a police organization could get a copter in the air that fast. Who else dealt with situations in which one could not simply flick it?

The copter landed in front of the Anderson house, after some trouble picking it out of the wild landscape. Police Lieutenant Richard Donaho climbed out carefully as soon as the dust had stopped swirling. For the benefit of the pilot his face was unnaturally blank. The fear of death had taken him the instant the blades started whirling around, and it was only now leaving him.

With the motor off, the alarm from the house was an intolerable scream. Lieutenant Donaho moved around to the side of the machine, opened a hatch and switched in the portable JumpShift unit.

He stood back as men and equipment began pouring through. Uniformed men moved toward the house, spreading out. Donaho didn't interfere. He wasn't expecting anything startling. It was going to be cold burglary, the burglar vanished quite away.

It was a smallish one-story house in a wild and beautiful setting, halfway up a mountain. The sun was still bright, though it had almost touched the western peaks. The sky was dark blue, almost lavender. Houses were scarce upslope, and far scarcer downslope. There were no roads. No roads at all. This place must have been uninhabited until twenty years ago, when JumpShift Inc. had revolutionized transportation.

The shrill of the alarm stopped.

In the sudden silence a policeman walked briskly from around the side of the house. "Lieutenant!" he called. "It's not burglary. It's murder. There's a dead man on the living room rug."

"All right," said Donaho. He called Homicide.

Captain Hennessey flicked in with the hot summer air of Fresno around him. It puffed out when he opened the door, and he felt the dry chill of the mountains. His ears popped. He stepped out of the belly of the copter, looking for the nearest man. "Donaho! What's happening?"

Donaho nodded at the uniformed man, whose name was Fisher. Fisher said, "It's around in back. Picture window shattered. Man inside, dead, with two holes in his back. That's as far as we've got. Want to come look, sir?"

"In a minute. What was wrong with the displacement booth? Never mind, I see it."

It was obvious even from here. The displacement booth was a standard model, a glass cylinder rounded at the top, with a dial system set in the side. Its curved door was blocked open by a chunk of granite.

"So that's why you needed the 'copter," said Hennessey. "Hum." He hadn't expected that.

It was an old trick. Any burglar knew enough to block the displacement booth door before trying to rob a house. If he set off an alarm the police couldn't flick in, and he could generally run next door and use the displacement booth there. But *here*—

"I wonder how he got out?" said Hennessey. "He couldn't set the rock and then use the booth. Maybe he couldn't use the booth anyway. Some alarms lock the transmitter on the booth, so people can still flick in but nobody can flick out."

Donaho shifted impatiently. This was a murder investigation, and he had not yet so much as seen the body.

Hennessey looked down a rocky, wooded slope, darkening with dusk. "Hikers would call this leg-breaker country," he said. "But that's how he did it. There's no other way he could get out. When the booth wouldn't send him anywhere, he blocked the door open and set out for . . . hum."

The nearest house was half a mile away. It was bigger than Anderson's house, with a pool and a stretch of lawn and a swing and a slide, all clearly visible

in miniature from this vantage point.

"For there, I think. He'd rather go down than up. He'd have to circle that stretch of chaparral . . ."

"Captain, do you really think so? I wouldn't try walking through that."

"You'd stay here and wait for the fuzz? It's not *that* bad. You'd make two miles an hour without a backpack. Hell, he might even have planned it this way. I hope he left footprints. We'll want to know if he wore hiking boots." Hennessey scowled. "Not that it'll do us any good. He could have reached the nearest house a good hour ago."

"That doesn't mean he could use the booth. Someone might have seen him."

"Hum. Right. Or . . . he might have broken an ankle anyway, mightn't he? Donaho, get that copter up and start searching the area. We'll have someone in Fresno question the neighbors. With the alarm blaring like that, they might have been more than usually alert."

Lieutenant Donaho had not greatly enjoyed his first helicopter flight, which had ended twenty minutes ago. Now he was in the air again, and the slender wings were beating round and round over his head, and the ground was an uncomfortable distance below.

"You don't like this much," the pilot said perceptively. He was a stocky man of about forty.

"Not much," Donaho agreed. It would have been nice if he could close his eyes, but he had to keep watching the scenery. There were trees a man could hide in, and a brook a man might have drunk from. He watched for movement; he watched for footprints. The scenery was both too close and too far down, and it wobbled dizzily.

"You're too young," said the pilot. "You young ones don't know anything about speed."

Donaho was amused. "I can go anywhere in the world at the speed of light."

"Hell, that isn't *speed*. Ever been on a motorcycle?"

"No."

"I was using a chopper when they started putting up the JumpShift booths all over the place. Man, it was wonderful. It was like all the cars just evaporated! It took years, but it didn't seem that way. They left all those wonderful freeways for just us. You know what the most dangerous thing was about riding a chopper? It was cars."

"Yah."

"Same with flying. I don't own a plane, God knows I haven't got the

money, but I've got a friend who does. It's a lot more fun now we've got the airfields to ourselves. No more big planes. No more problem refueling either. We used to worry about running out of gas."

"Uh huh." A thought struck Donaho. "What do you know about off-the-road vehicles?"

"Not that much. They're still made. I can't think of one small enough to fit into a displacement booth, if that's what you're thinking."

"I was. Hennessey thinks the killer might have set off the alarm deliberately. If he did, he might have brought an off-the-road vehicle along. Are you sure he couldn't get one into a booth?"

"No, I'm not." The pilot looked down, considering. "It's too damn steep for a ground-effect vehicle. He'd leave tire tracks."

"What would they look like?"

"Oh, God. You mean it, don't you? Look for two parallel lines, say three to six feet apart. Most tires are corrugated, and you'd see that too."

There was nothing like that in sight.

"Then, I know guys who might try to take a chopper across this. Might break their stupid necks, too. That'd leave a trail like a caterpillar track, but corrugated."

"I can't believe anyone would walk across this. It looked like half a mile of bad stairs back there. And how would he get through those bushes?"

"Crawl. Not that I'd try it myself. But they don't want me for the gas chamber." The pilot laughed. "Can you see the poor bastard, standing in the booth, dialing and dialing—"

Lucas Anderson had been a big man. He had left a big corpse sprawled across a sapphire-blue rug, his arms stretched way out, big hands clutching. They had been dragging a dead weight. One of the holes in his back was high up, just over the spine.

And men moved about him, doing things that would not help him and probably would not catch his killer.

Someone had come here expressly to kill Lucas Anderson. He would have some connection with him, in business or friendship or enmity. He might have left traces of himself, and if he had, these men would find him.

But the alibi machine might have put him anywhere by now. With a valid passport he could be in Algiers or Moscow.

Anderson's bookshelf of his own

works showed some science fiction titles. His killer *could* have been a spaceman—and then he could be in Mars orbit by now, or moving toward Jupiter at lightspeed as a kind of supernutrino.

Yet they were learning things about him.

The cleaning machines had come on as soon as the alarm had been switched off. An alert policeman had got to them before they could do anything about the mess.

There was no glass on the body.

There was no glass under the body either.

"Now, that's not particularly odd," the man in the white coat said to Hennessey. "I mean, the pattern of explosion might have done that. But it means we can't say one way or another."

"He could have been dead when the shot was fired."

"Sure, or the other way around. No glass on him could mean he came running in when he heard all the noise. Just a minute," the man in the white coat said quickly, and he stooped far down to examine Anderson's big shoes with a magnifying glass. "I was wrong. No glass here."

"Hum. Anderson must have let him in. Then he shot out the window to fox us, and set off the alarm. That wasn't too bright." In a population of three hundred million Americans you could usually find a dozen suspects for any given murder victim. An intelligent killer would simply risk it.

Someday, Hennessey thought when the black mood was on him, someday murder would be an accepted thing. It was that hard to stop. But this one might not have escaped yet . . .

Id like to get the body to the lab," said the man in the white coat. "Can't do an autopsy here. I want to probe for the bullets. They'd tell us how far away he was shot from, if we can get a gun like it, to do test firing."

"If? Unusual gun?"

The man laughed. "Very. The slug in the wall was a solid fuel rocket, four nozzles the size of pinholes, angled to spin the thing. Impact like a .45."

"Hum." Hennessey asked of nobody in particular, "Get any footprints?"

Someone answered. "Yessir, in the grass outside. Paper shoes. Small feet. Definitely not Anderson's."


"Paper shoes." Could he have planned to hike out? Brought a pair of hiking boots to change into? But it began to

/turn to page 54



*"... the alarm
screamed to the hills,
Help! I am being
robbed . . . but the
booth wouldn't let him
out. In all the vastness
he was locked in,
locked in with the
body."*





HOW BIG IS THE UNIVERSE TODAY, MOMMY?

article/Igor Bohassian

Through the ages since man started recording the events about him there has been one facet of knowledge that has undergone a steady revision. At any given time in history the people of that period were sure that this particular piece of knowledge was, at last, completely correct. And, invariably, the following generation laughed at the lack of perceptiveness of their forefathers. The subject of constant change? The size of the universe.

We don't know how big the first civilizations, Harappa, Mohenjo-daro, Sumer, or the Red and White kingdoms of the Nile, thought the universe was, since no written records on the subject have come down to us. The first speculations seem to have been by the Greeks, who assumed that the flat world was "about that size" (pick your own figure; just so it's too big to be verified by taking a short walk), with the "ceiling" of the sky just barely clearing the tops of the mountains. Thus the legend of Atlas holding up the sky.

The first person on record to do any real measuring was Eratosthenes of Cyrene. By 240 B.C., when Eratosthenes was head of the Library at Alexandria, it was generally supposed that the Earth was spherical (a notion *not* invented by Columbus). Eratosthenes reasoned that if the Earth was spherical then there should be a difference in the angle at which the sun's rays strike the Earth at two different spots at the same time. At noon on June 21st the sun's rays struck the surface of the Earth at an angle of $7\frac{1}{2}$ degrees from the perpendicular. However, 500 miles to the south, in the town of Syene, at the same time and on the same day, the sun's rays formed a right angle to the surface. Knowing the sun's angle at Alexandria and the distance to Syene, it is possible, through simple geometry, to calculate the distance to the center of the Earth, and therefore the circumference of Earth. His figures indicated that Earth was 8,000 miles in diameter and 25,000 miles in circumference, figures very close to being correct.

One of the reasons the Greeks were so certain the Earth was spherical was that they had already surmised that eclipses of the moon were caused by the Earth coming between the sun and moon. The Earth's shadow, as it passed over the moon, showed a distinct curvature, indicating that the general shape of the Earth must be round. We aren't sure who made the jump from roundness to sphericalness, but the Greeks, being well into solid geometry (*geo* from the Greek for Earth), seem to have completely bypassed the idea of a round, flat Earth.

About 150 B.C. Hipparchus of Nicaea used geometry in an attempt to discover the distance to the moon, the first at-

The discovery of other galaxies, island universes containing millions of suns, forced scientists to the conclusion that perhaps the universe can't be measured, simply because there is no end to it. Today the astronomers can see objects nine billion light years away!

tempt at accurate, scientific measurement of an astronomical distance. He had Eratosthenes' figures for the size of Earth, and the speculations of Aristarchus of Samos that, if the Earth was indeed spherical, it ought to be possible to calculate the relative sizes of the Earth and moon from the shadow cast during an eclipse. Once the relative sizes were known it would be possible to calculate the distance between the two bodies.

Hipparchus figured that the moon's distance was thirty times the diameter of Earth. Using the 8,000 mile diameter figure determined by Eratosthenes, Hipparchus decided the moon was about 240,000 miles from Earth, a remarkably accurate figure considering the methods used and the lack of knowledge regarding the true shape of the Earth and the moon's orbit.

As far as the measurement of astronomical distances was concerned, that's where matters rested for nearly 1,800 years. For one thing, the moon was the limit of how far away bodies could be measured by strictly geometrical and observational methods. Geometry had the answers, but it wasn't until the invention of the telescope that man was able to start measuring angles small enough to give figures for other heavenly bodies. To all intents and purposes, from 240 B.C. until 1,600 A.D. the universe was some half-a-million miles in diameter, with the Earth at the center and the sun an unknown distance away.

Then, in 1673, Jean Dominique Cassini made use of parallax to measure an astronomical distance. To start with, Johannes Kepler, 64 years before Cassini, had determined that the orbits of the planets were ellipses, not true circles. With this discovery it became possible to lay out a scale-model of the solar system, with all the relative distances between bodies known. What was needed was an actual measurement of distance between Earth and any of the planets, and the distance to all the other planets, from Earth and from each other, could be figured.

Cassini provided that measure, by determining the parallax of Mars.

How parallax works is easily demonstrated. Hold your hand out at arms length, with one finger raised. Look at it first with one eye, then with the other, and note how your finger seems to move against the background. Now move your hand in so that your finger is only a foot away from your eyes and repeat looking at it with first one eye, then the other. Notice that the shift against the back-

ground is much greater when your hand is close. Knowing the distance between your eyes, the *baseline*, it is possible to calculate the distance to your finger by the amount of shift observed against the background. This same procedure can be used to measure astronomical distances, with, of course, a much larger baseline than the distance between your eyes.

Cassini determined the position of Mars against the stars, which, being so much further away, formed a relatively



fixed background. At the same time his colleague, Jean Richer, made the same observation in French Guiana. Combining the two parallax angles, Cassini was able to calculate the distance to Mars that particular night, and at that particular spot in its orbit, and, using the Keplerian scale model of the system, was able to calculate that the sun was 86 million miles away, a figure which was only 7% off—remarkable accuracy considering the instruments they had to work with. Remember, this was in 1673!

During the next 150 years the distances between planets in the solar system were measured with greater and greater accuracy. By the early 19th Century it was known that Pluto, the outermost planet, was some 7,300 million miles from the sun, and there were comets which went even further out, giving a solar system which was at least 10 billion miles across. This was just our solar system, though. Now the astronomers turned their attention to the stars, unknown objects at unknown distance.

At first it was assumed that the stars, whatever they might have been, were some hundreds of billions of miles away, and, since some were brighter than others, that some were closer than others. If this was the case, then the closer ones should be measurable against the farther ones by parallax. Unfortunately, no parallax could be discerned. The next step was to use the full width of Earth's orbit as a baseline for measurement, some 186 million miles, making the parallax measurements six months apart.



THE ANDROMEDA GALAXY, FLANKED BY TWO SATELLITE GALAXIES, NGC 205 AND NGC 221.

Still no parallax angle was discernable, and it didn't take the astronomers long to come to the conclusions that (a) the stars were unimaginably far away, and (b) to be visible at that distance they had to be burning balls of gas like our own sun.

Then, in the 1830's, Friedrich Wilhelm Bessel used the newly invented heliometer to measure the distance between 61 Cygni and another star which proper motion showed was much farther away. The heliometer was able to measure extremely small distances, and for more

Some scientists speculate that clouds of glowing gas such as this remnant of an exploded star form the nucleus for new stars to form, and present this as evidence for a steady state universe. If such is the case then the universe may, indeed, be endless and therefore unmeasurable.

than a year Bessel noted the changes in distance between 61 Cygni and the plotting star. Then, in 1838, he reported that 61 Cygni had a parallax of .31 seconds of arc with Earth's orbit as the baseline. This meant that 61 Cygni was 64 *trillion* miles away, some 10,000 times the total width of our solar system. Light from 61 Cygni, moving at 186,282 miles per second, takes 11 years to reach Earth.

Only months later Thomas Henderson measured the parallax of Alpha Centauri and found it to be .75 seconds of arc, putting the three-star Centauri cluster



some 4.3 light years away. The next year Vega was found to be 27 light years away, and by 1900 the distances to some 70 stars had been determined. Unfortunately, parallax had reached its limits. Distances of over 100 light years were impossible to measure by this method, and it was now obvious that most of the stars were a lot farther away than that.

Looking up at the sky on a clear night you can see about 6,000 stars. However, with the invention of the telescope it became obvious that this was but a

small fraction of the total number of stars. Examining the band of the milky way through a telescope showed that this haze of light was actually millions of stars, and in the 1780's William Herschel began trying to make some sense out of this newly discovered universe. First Herschel suggested that the galaxy (the milky way in Greek) was lens shaped, then he tried to determine how big it was and how many stars there were in it. By doing a statistical count (counting random small areas then using the average count of the small areas to determine the total count of the total area) Herschel decided that there were about 100 million stars in the galaxy. He next assumed that all stars were of the same brightness, so a star that is one-ninth as bright as another is three times farther away. Going on this assumption Herschel decided that the galaxy was 850 times the distance to Sirius in diameter and 155 times the distance to Sirius in thickness. Unfortunately, Herschel didn't live long enough to find out how far it was to Sirius. When that distance was measured by parallax it was found to be 8.8 light years, which gave a universe some 7,500 light years in diameter and 1,300 light years thick. To a science which, one-hundred years before, had considered 7,300 million miles (some 11 light hours), the diameter of Pluto's orbit, an almost unbelievable distance, the figure 7,500 light years was completely unreasonable, and many rejected it out of hand. There is no way they could have accepted the fact that even this figure was much too conservative.

In 1906 Jacobus Cronelis Kapteyn began to duplicate Herschel's work, and with a knowledge of the distance to the nearer stars and photography at his disposal he quadrupled Herschel's estimates, deciding that the galaxy was some 23,000 light years across and 6,000 light years thick. Tremendously larger than Herschel's estimate of 130 years before, but still not large enough.

The next step in the measurement of the universe started with the discovery that certain stars were not steady in their light output. They seemed to pulse, to vary in output, and since the first such star discovered was Delta Cephei, this type of star has come to be known as a *Cepheid variable*.

As more and more variable stars were discovered it was noticed that they had markedly different periods, ranging from a matter of hours to almost two months. Henrietta Leavitt, studying the Small Magellanic Cloud in 1912, discovered 25

Cepheid variables, and in the course of measuring their periods discovered that the longer the period, the brighter the star.

The reason this correlation had not been discovered during the examination of Cepheid variables in our local area was that there was no way of determining the actual brightness of a star, its *absolute magnitude*. We can tell how bright a star appears to be, its *apparent magnitude*, but unless we know how far away it is we cannot determine its true magnitude.

However, the Small Magellanic Cloud is so far away from us, some 170,000 light years, that in effect all the stars are at the same distance from us, and therefore the apparent and absolute magnitudes are the same. Because of this Miss Leavitt was able to develop the "period-luminosity curve," which showed what *absolute magnitude* a Cepheid variable of a given period must have, and what period a variable of a given absolute magnitude must have. Now astronomers had a measure of relative distance, just as they had in regards to the solar system when Kepler determined the orbits of the planets. What they did not have, just as Kepler did not have, was an actual distance measurement. What they needed was to find the absolute magnitude of just one variable, and they would be able to measure the galaxy.

Using statistical methods with proper motion as a guide (the movement of a star from month to month against the background of more distant stars) and the known distance of closer stars as a factor, Ejnar Hertzsprung found that a Cepheid variable with an absolute magnitude of -2.3 had a period of 6.6 days. This discovery was made in 1913, and a few years later Harlow Shapley repeated Hertzsprung's work and got an answer of 5.96 days. The two answers were close enough to give the astronomers the distance to one variable, which gave them the distance to all variables.

Shapley decided to concentrate on measuring the periods, and therefore the absolute magnitudes, of those Cepheid variables found in globular clusters. Several of these clusters had been discovered, consisting of millions of stars packed into "bunches" with diameters on the order of only 100 light years. There are somewhere between one and two-hundred globular clusters in our galaxy, and by examining the variable stars in those clusters which are visible through the telescope Shapley determined that the clusters, which ranged



from 20,000 to 200,000 light years from us, formed a spherical shell, presumable around the center of the galaxy, since the lens-plane of the galaxy cut the shell of clusters in half. Plotting the center of these clusters gave a figure of 300,000 light years for the diameter of the galaxy, and showed that we were not at the center of the galaxy, as the appearance of the milky way indicated, but out towards one edge. Shapely went too far in his estimate of the size of the galaxy by a factor of three, but there were factors which he could not know about which threw his calculations off. The principle one was that the galaxy is filled with dust, so much dust that we receive only about 1/10,000 of the light emitted by the galactic center. Some of that dust

It wasn't until variable output stars were discovered, their periods measured, and their distances found that the true size of our Galaxy was determined. The final determinations were made by measuring the distances to the globular clusters which surround the center of our Galaxy.

dimmed the light from the clusters Shapley was using to plot the center of the galaxy, leading him to think they were much farther away than they actually were.

His mistake was discovered when another astronomer, Jan Oort, measured the true diameter of the galaxy. In 1926 Oort decided to measure the speed at which the galaxy is rotating. Since it was assumed that the various stars of the galaxy revolved around the galactic center, just as the planets revolve around the sun, it was also assumed that those stars closest to the center would be moving fastest, and those out towards the rim would be moving slowest, just as Mercury moves faster than Pluto. If this was the case, then those suns closest to



the center of the galaxy would be pulling ahead of us in relation to the center, while those out towards the rim would be falling behind us.

Accepting these assumptions, it became possible to calculate how fast various stars were rotating around the galactic center by observing their relative motion. It was soon determined that the galaxy was rotating once every 200 million years or so, and, knowing the speed of rotation, it was possible to determine the gravitational force of the galactic center, and therefore its mass. Knowing the mass of the galaxy, and the mass of an average sun such as ours, it was possible to estimate with some certainty that our galaxy contains some 150 billion stars.

Measuring the mass of the galaxy, or the number of stars in it, didn't do much for telling us how big it was, though. In the course of measuring the rotation of the galaxy Oort has figured the curves for a great number of stars around the galactic center, though, and even though the orbits of those stars were ellipses, it was easy to determine that the center around which those stars were revolving was some 27,000 light years away, and that the distance from the center to the edge was 50,000 light years, giving a 100,000 light year diameter.

During this same period the distance to the two Magellanic clouds was being measured by measuring the magnitudes of the Cepheid variables there, and it was determined that the large cloud, with some 5 billion stars, is 150,000 light years away, and the small cloud, with 1.5 billion stars, is 170,000 light years distant. By the end of the Twenties, when the last of these measurements was made, our universe was known to be some 200,000 light years across.

In 1673 Cassini measured the solar system and proved that the universe was tremendously large, with the sun being some 90 million miles away. In 250 years that distance had sunk to insignificance, and the astronomers had begun to ask if there was anything more, if there might be other galaxies. Clear back in 1755 Immanuel Kant had suggested such new galaxies, calling them "island universes," and in 1924 Edwin Powell Hubble began to examine the Andromeda Nebula, a dim patch of light in the constellation of the same name, with the new 100 inch telescope on Mt. Wilson. At once the outer edge of the nebula was seen to be composed of individual stars, among them Cepheid variables which gave a distance for the An-

Science was startled to find that our Galaxy, once thought to be the entire universe, is actually only one of many.



dromeda galaxy of one-million light years.

Other nebulas turned out to be new galaxies when examined through the telescope, and now astronomers began thinking about a universe that might be hundreds of millions of light years across. However, some problems began cropping up. For one thing, it appeared that all these newly discovered galaxies were smaller than our own. Then, during the Forties, Walter Baade discovered that there were two types of Cepheid variables, the type we can see, which are found primarily in the globular clusters, and another type, which were used to measure the distance to Andromeda. None of this second type are readily visible in our own galaxy, which explains why the two types had not been discovered before Baade spotted them in Andromeda.

Examination of this new type of variable soon showed that there had been a massive error in computing the distance to the Andromeda Galaxy. Instead of being one-million light years away, it is 2½ million! And, as more and more galaxies were discovered, it was discovered that Andromeda is actually rather close to us. As a matter of fact, it was soon discovered that galaxies exist in clusters, and both our galaxy and Andromeda are part of our local supergalaxy, which contains 19 separate galaxies.

Just when the idea of supergalaxies was beginning to take hold, along came 3C273, one of the radio sources discovered by the relatively new science of radio-astronomy. Several of these radio sources had been plotted, and when the 200 inch Hale telescope was turned on their coordinates small stars were seen. Then, it was discovered that, whatever they might be, they weren't stars. The astronomers started calling

them quasi-stellar sources, a term that was soon shortened to *quasar*.

Once the astronomers discovered they weren't dealing with stars which happened to be strong radio emitters they turned on the full battery of tests to find out just what these objects were. Spectrographic analysis was made, but the results didn't make any sense. Then, in 1963, Maarten Schmidt, working on the spectrogram of 3C273, determined that the spectrogram made sense if he assumed a tremendous red shift. As an object moves away from a viewer the light seen by the viewer is shifted towards the red end of the spectrum, and the faster the object is moving away, the greater the amount of shift. However, for the shift to move as far towards the red as this one appeared to do, the recession would have to be at over 25,000 miles per second.

The fact that the universe is expanding, that all the other galaxies are moving away from us, has been known for some time. During the early Thirties Edwin Powell Hubble formed what came to be known as "Hubble's Law," that objects expanding away from us are doing so at speeds proportional to their distance from us. That is, if Galaxy A is twice as far from us as Galaxy B, it will be moving away from us twice as fast as Galaxy B. Observations over the years had borne out Hubble's Law, but if the law held with regard to the Quasars they had to be the most distant objects ever seen.

By the early part of 1973, when this is being written, well over 150 quasars have been discovered, and some of them are showing recession speeds of 150,000 miles per second, which puts them some 9 billion light years away. What objects might still be waiting out in space to be discovered? How much bigger is the universe than the 9 billion light years we know about today? That is something that no one can answer. By the time this reaches print the universe may have grown another notch, as it has grown so many times in the past. Today astronomers think they have found a limit for the size of the universe—11 billion light years. If Hubble's law holds, then anything more than 11 billion light years away will be moving away from us faster than light, and therefore we will have no way of observing it. True? Who knows? Considering how much the universe has grown, or at least our idea of the size of it has grown, in the past 2,500 years, I don't want to be the one to say that "this is how big it is." All I can say is, "this is how big it is today!" ☉



*No matter how carefully a man plans a crime,
if he should forget to leave openings for the
unexpected he is taking a chance on having his
careful plans prove to be worthless.*

look like the killer hadn't planned anything so elaborate.

The dining setup would indicate that Anderson hadn't been expecting visitors. If premeditated murder could be called casual, this had been a casual murder, except for the picture window. Police had searched the house and found no sign of theft. Later they could learn what enemies Anderson had made in life. For now—

For now, the body should be moved to Fresno. "Call the copter back," Hennessey told someone. They'd need the portable JumpShift unit in the side.

When the wind from the copter had died Hennessey stepped forward with the rest, with the team that carried the stretcher. He asked of Donaho, "Any luck?"

"None," said Lieutenant Donaho. He

climbed out, stood a moment to feel solid ground beneath his feet. "No footprints, no tracks, nobody hiding where we could see him. There's a lot of woods where he could be hiding, though. Look, it's after sunset, Captain. Get us an infrared scanner and we'll go up again when it gets dark."

"Good." More time for the killer to move . . . but there were only half a dozen houses he could try for, Hennessey thought. He could get permission from the owners to turn off their booths for awhile. Maybe.

"But I don't believe it," Donaho was saying. "Nobody could travel a mile through that. And the word from Fresno is that the only unoccupied house is two miles off to the side!"

"Never a boy scout, were you?"

"No. Why?"

"We used to hike these hills with thirty pounds of backpack. Sull . . . hum." He

seemed to be studying Donaho's face. "Is Anderson's booth back in operation?"

"Yes. You were right, Captain. It was hooked to the alarm."

"Then we can send the copter home and use that. Listen, Donaho, I may have been going at this wrong. Let me ask you something . . ."

Most of the police were gone by ten. The body was gone. There was fingerprint powder on every polished surface, and glass all over the living room.

Hennessey and Donaho and the uniformed man named Fisher sat at the dining table, drinking coffee made in the Anderson kitchen.

"Guess I'll be going home," Donaho said presently. He made no reference to what they had planned.

They watched through the window as Lieutenant Donaho, brilliantly lighted, vanished within the glass booth.

After that they drank coffee, and talked, and watched. The stars were very bright.

It was almost midnight before anything happened. Then, a rustling sound . . . and something burst into view from upslope, a shadowy figure in full flight. It was in the displacement booth before Hennessey and Fisher had even reached the front door.

The booth light showed every detail of a lean dark man in a rumpled paper business suit, one hand holding a briefcase, the other dialing frantically. Dialing again, while one eye in a shyly averted face watched two armed men strolling up to the booth.

"No use," Hennessey called pleasantly. "Lieutenant Donaho had it cut off as soon as he flicked out."

The man released a ragged sigh.

"We want the gun."

The man considered. Then he handed out the briefcase. The gun was in there. The man came out after it. He had a beaten look.

"Where were you hiding?" Hennessey asked.

"Up there in the bushes, where I could see you. I knew you'd turn the booth back on sooner or later."

"Why didn't you just walk down to the nearest house?"

The lean man looked at him curiously. Then he looked down across the black slope, to where a spark of light showed one window still glowing in a distant house. "Oh, my God. I never thought of that." ○

CRASH CAMERON AND THE SLIME BEAST

from page 39

was used to having her around, and, despite all of her shortcomings, he did not want anything *serious* to happen to her. Faithful female companions were hard to come by.

Crash Cameron checked his ray blaster to see that it was still fully charged and stepped from the airlock. The purple sand of Planetoid KM-12 crunched under the tread of his heavy magno-boots as he followed a trail of mucus which obviously marked the path taken by Aula's abductor. The light of the distant sun glinted on the Earthman's glassine helmet and gleamed on his feature-bronzed, ruggedly handsome features.

Crash knew that he did not really need to wear the bulky spacesuit and round helmet on Planetoid KM-12, since one of the myriad marvelous qualities of Unrealium XZ was its ability to generate a breathable atmosphere. Crash, as a matter of fact, had not even strapped oxygen bottles to his back. But he had never been able to feel completely clothed unless he was wearing both suit and helmet, and it was only by dint of incessant harping upon her part that Aula ever got him to remove the latter long enough to brush his strong, white teeth. Aula herself, to the best of his knowledge, had never tried on her own spacesuit. She preferred bikinis and little tunics which accentuated, rather than concealed, her comely form.

The rolling expanse of purple sand soon gave way to a series of rocky hills. The slime trail led into the yawning black mouth of a cave set in the side of a rugged cliff.

Ray blaster at the ready, Crash Cameron switched on the infra-light projecto-disk built into the big, round buckle of his belt. The infra-light bathed the interior of the cave and revealed a smooth, sandy floor, twisted masses of stalactites and damp walls covered with strange graffiti:

**TARS TARKAS SUCKS
RAW EGGS
GRAG LOVES OTHO
ELLISON SAVES
I LIKE GRILS!**

The Trouble-Shooter of Tomorrow entered cautiously and crept forward, soon noticing that the floor of the cavern sloped gradually downward into the

heart or bowels, whichever, of Planetoid KM-12.

After fifteen minutes' stealthy progress, he emerged abruptly into a large, dimly lighted chamber. In the center of the room, on a crude stone dais, Aula, her smooth creamy globes straining at their silken prisons, writhed in the gooey clutches of a hideous monstrosity, the like of which Crash had never seen in all of his travels throughout the solar system. The beast was massive and floppy and unspeakable, with patches of green mottling upon its corpse-gray skin. It had long, waving antennae which terminated in enormous multi-faceted eyes, plus mandibles, tenacles, spines, spikes, bumps, warts, wattles and a weak chin.

Cold rage settled over Crash Cameron as he heard Aula moan in the thing's loathsome embrace. The Earthman shot from the hip and had the satisfaction of seeing destructo-rays sear through the obscenely bloated mass.

With an inhuman wail, the slime beast turned from Aula, slithered off of the dais to land with a wet plop on the sandy floor, and advanced upon the unflinching Earthman. Its loose, flabby lips drew back to reveal sharp teeth as long as a man's fingers.

A grim smile touched Crash Cameron's lips as he aimed his ray blaster straight at the creature's gross maw and

pressed the firing stud. The death-dealing beams leaped from the ray blaster's muzzle and disappeared down the thing's gullet. The slime beast vanished noisily amid a cloud of stinking, oily smoke.

Her hands pressed tight against her heaving bosom, Aula slid her befouled legs over the edge of the dais as Crash stepped around the blackened spot where the monster had been atomized. Viscid slobber covered the girl from head to foot. Her bikini was in tatters. Her face was a mask of horror commingled with shock and disgust as she looked at first the scorched sand and then the Trouble-Shooter of Tomorrow.

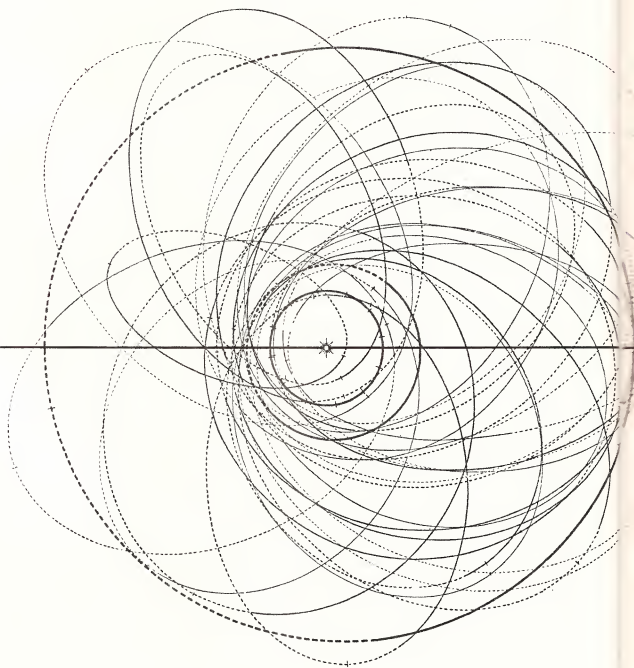
"Oh, Crash!" Aula sobbed. "You big, dumb lug! What did you have to do that for? The creature didn't harm me!" Crash, who had been moving forward to catch her in his outstretched arms, stopped dead in his tracks, utterly flabbergasted. "You ruined it! Jerk! And just when, for the first time in my whole life, I was beginning to *feel* like a woman!"

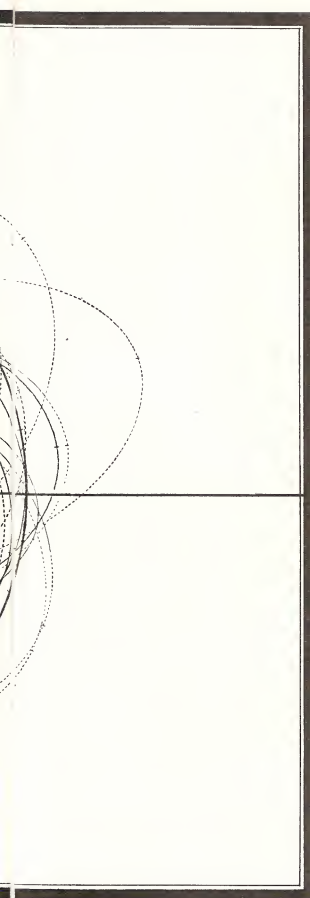
Crash Cameron shook his head in bewilderment. "What are you talking about, Aula?"

"The slime beast and I ran away together, stupid!" O



Crash knew that he would have to risk his own life and the success of his mission if he was to save the lovely Aula. He wasn't sure, though, that she was worth it.





THE NEGLECTED MAJORITY

article/Dr. Gregory Benford

On a clear night, with good binoculars or a simple telescope, you can see most of the planets. Mercury is too near the sun to be easily picked out, and Pluto is too small and far away. The rest—Venus, Mars, Jupiter, Saturn, Uranus and Neptune, counting outward from the sun—are bright beacons that have beckoned generation after generation of astronomers to study them.

But there are other objects in the solar system just as interesting. They are smaller than planets, but not so small that they can be dismissed as mere dust or chunks of rock. Let's call them planetoids—small planets. This includes all the moons of the planets—there are 32 of them—and the inhabitants of the asteroid belt, which number into the many thousands.

Aside from the nine planets, our system has 32 moons and thousands of asteroids, and perhaps some of the most important space exploration will be done there.

Though they are by far the most numerous class of objects in our solar system, little is known about planetoids. They haven't been studied as intensively as the planets by astronomers. After all, they are, by definition, smaller, and thus harder to see. They are also less earthlike than Mars or Venus, and to most astronomers seem very unlikely places to find life. Still, this neglected majority is going to become more prominent as the exploration of space advances. Men will visit them, study their surfaces, perhaps mine them for ores or even live inside them.

The planetoids are leftovers. The planets were formed about 4.3 billion years ago, probably by a random process of clumping larger and larger conglomerates of rock and dust together. Some small fraction of the matter wasn't swept up by a planet, though. This debris formed small clumps, either in places where the gravitational pull of a planet was too weak to capture it (the asteroid belt), or in a stable orbit very close to a planet (the moons).

The interesting facet of such leftovers is that they are the original substances that made up our solar system. Matter on earth has been changed through geological and biological processes, so what we see on the surface is quite different from the original material that formed the planet. This is very probably true of the other planets as well. But asteroids and moons are smaller and experience much less geological turmoil—they probably don't form heavy metal cores and well-defined crusts, as planets do. Planetoids, then, are the basic building blocks from which our solar system started out. If we are ever to solve the riddle of our origins, we must someday get samples of the asteroid belt (or various moons) and compare them with our common earthly materials.

There is one obvious exception to the neglected planetoid majority—our moon. We have explored it (very tentatively) and brought back samples. But some astrophysicists feel the moon is atypical of the planetoids. In fact, we are not really sure how the moon got where it is, or what made it. Some think our moon was an asteroid that was captured by the earth in the early phase of the solar system. Others believe it formed more or less simultaneously with the earth. Our moon may or may not be typical of the early solar system. One thing is sure, though—some separation

into core and crust has taken place, so that rocks collected on the moon's surface aren't likely to be the same as the original stuff that formed the moon. To find such matter, we must eventually go to the asteroid belt or beyond.

Deep space missions to these small bodies are even now within reach of our technology. There are asteroids that come quite close to earth—the record is about four times as far away as our moon—as they orbit in toward the sun. We could reach those, or even the more sedate asteroids which circle the sun between Mars and Jupiter.

What will we find there? First, the smaller planetoids are quite irregular. Gravitational forces are not strong enough to shape them into spheres, like the planets. They are literally flying mountains, jagged and rough. Gravity is not absent, though. Every material body in the universe has some gravitational attraction, however weak. An asteroid about 4.8 miles in diameter will still hold a man to its surface, for example, if it isn't spinning. By this we mean that a man in reasonably good physical condition could jump off the asteroid and rise to great heights—but he would inevitably fall back to the surface. If the asteroid were smaller, he could leave it entirely, unassisted by rockets.

The same hypothetical astronaut could throw a baseball completely off such a small planetoid. He could do it, in fact, until he visited an asteroid 32 miles in diameter. A baseball thrown upward at a good, professional speed—110 miles an hour—would escape from any planetoid smaller than this. (You may be surprised that a baseball can be thrown so fast, but Bob Feller was clocked pitching at 125 mph. In my calculations I assume a Feller-class astronaut, and conveniently forget about the difficulties of throwing in a space suit.)

As the astronaut visits progressively larger and larger asteroids, things become more interesting. In the 1930 science fiction magazines an occasional story appeared, sometimes titled *Murder in the Asteroids* or something similar. The plot was standard, with one original ingredient: the villain laid a trap for the hero, using only Isaac Newton's laws of motion. An object fired off an asteroid can go into orbit around it, just as Sputnik went into orbit around the earth. Because the asteroid has no atmosphere, the missile can be launched into orbit directly from the surface, simply by firing it parallel to the ground.

This means the "missile" will have an orbit that loops out from the asteroid in a long ellipse, and then returns, passing close to the surface at the same point from which it was launched. Now, for "missile" substitute "rifle bullet." The villain fires a rifle slightly above the distant horizon of the asteroid, and a few hours later the bullet returns—captured in a stable orbit. If our villain knows for sure that the hero will be standing in a certain spot at a certain time—presto. When the hero is done in, the villain can be far away, with a perfect alibi.

Can this work? Perhaps, surprisingly, yes. There is one technical quibble which may have occurred to you—that the gravitational field will be warped because the asteroid itself is irregular—but this is easily eliminated. An asteroid big enough to capture a rifle bullet into an orbit would be at least 800 miles in diameter. Such a large body can't be a "flying mountain"—gravitational forces will shape it into a sphere. This means the gravitational field around it will be comfortably spherical and the rifle bullet will return to drill the hero.

It will be the cleverest murder ever committed, if anyone gets a chance to bring it off.

A body so large, though, is no longer a simple asteroid. Only moons of the larger planets are larger than 800 miles in diameter. Probably moons are more sizable than asteroids because the concentration of original dust and rock near the massive planets was higher than elsewhere. Whatever the reason, the moons of the gas giant planets (Jupiter, Saturn, Uranus, Neptune) are immense. Ganymede, the largest, is the 4th moon of Jupiter and has fully half the mass of Mercury, the smallest planet.

Once we begin thinking about such relatively large bodies, a host of questions arise. The most interesting armchair speculation about such small worlds is what men will be able to do there. One of man's oldest dreams is of flight, not by mechanical devices but under his own power. On earth this is impossible. Some time ago a wealthy Briton set a large cash prize for the first man who cut a fly one mile under his own power, assisted by a motor. This means building a light airframe and powering it by pedaling at a bicycle sort of arrangement, to turn a propeller. Added to the one mile requirement was that the flight be a figure eight, thus demanding steering and control as well as power. No one has come even close

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THE JEWEL

The Jewel was a gift, and he thought he was set for life. He was learning, though, that his life might not be very long anymore.

fiction/D. William Paul
art/Monte Rogers

I was bitterly cold in Thunderburg, a cold that seemed to come straight from the dead bones of the red planets past. A cold that seemed to rise like a tangible mist from the depths of the Martian craters and penetrate right through the insulated sand-suit the tall, thin Earthman was wearing.

Barney dropped his robocarb near the center of town, as far as he could get from the dome's main port where Eagleton's men had picked him up, and dashed across one edge of Chronicle Park, trying to stay in the shadows.

Over the whine of robocabs and the deep drone of the freight carriers headed out of the city toward the mines he almost didn't hear the white-hot hiss of the laser that melted a chunk of impacted sand from the wall of the Rotsler building, not a foot from his ear. For a split second he stared stupidly at the still-bubbling crater, then he dived headlong into the entryway flower bed, breathing in gasps the odor of canal-fruit and death, trying to crawl under the thin layer of mixed Earth-soil and sterile Martian sand.

As he lay there, trying to hold the pounding in his ears to a minimum, straining for the sound of approaching steps, traffic continued to roar by. Cautiously he lifted his head and looked around, expecting each second to be his last. There were about a thousand robocabs in Thunderburg, along with another thousand or so freight carriers hauling germanium and rare earths from the mines outside of town, and they all seemed to be on the broad roadway in front of him at once. The shot had come from out there, from somewhere in the traffic. If it had been someone in a robocab, they could be halfway to Clarke before anyone discovered Barney's body. But Barney wasn't dead—at least not yet.

He stood up, shivering with reaction, and walked across the street, back towards Chronicle Park. There was an old robot space-can, converted into a coffee-counter, standing on the corner, and in the cold air the smell of fresh coffee, even coffee from the stunted beans they were now growing in the hydro-farms on Mars, filled Barney's mouth with saliva. He started for the stand, then saw the little guy, wearing a shiny-new sand-suit that still had creases from the box it came in, standing back inside the can, watching him.

Again Barney crossed the street, ducking under the edge of the Rotsler Building to get out of the glaring lights from the fifty-foot-high posters adver-

tizing the latest in sex films for the womankind-hungry astroid miners. He hurried down the quiet side-street, checking behind him to see if anyone was following, if death was still stalking him as it had for the past three months.

When he was sure he had escaped the man or men who had taken a shot at him he cut over to Burroughs Boulevard, ducked into the entryway to an apartment complex, and went across the bare patio. He fumbled for a second with his keys, then finally released the electrolock on the outer door of the emergency lock. The inner door was open, blocked open by accumulated dirt. It had been thirty years since anyone had seriously worried about a dome failure, and only Barney's newness to Mars made him nervous about the inoperative emergency door, designed to hold pressure in the apartment should the dome split.

Dorothy was asleep. She lay curled in a soft, warm ball, like a kitten snuggled down, half-on and half-under the covers crumpled about the bed. One softly browned breast was exposed above the pale-blue sheet and her dark hair was curled in little whips around her face, framing it in childlike innocence. Barney walked silently into the small kitchen and put on some hot water for coffee. While the water heated he went back into the bedroom, his body still too excited to sit still.

Although Barney was moving as quietly as a shadow, with the ingrained grace of a deep-space-man, Dorothy awakened, opened her eyes and sat up on the bed, letting the sheet fall to her waist, exposing the outline of dark hair at the base of her stomach, a hint of invitation that Barney found hard to resist despite his tenseness.

"What is it, Barney? What's the matter?"

"Nothing. I just wanted some coffee." Barney turned away as he spoke. He wasn't used to lying, and it didn't come easy to him. He'd been too long away from normal human contacts.

Dorothy rubbed the sleep from her eyes with her fists, like a little girl. "Come on, baby. I know that look. You've been outside, haven't you?"

"Yeah. And Eagleton's goons are back. Or maybe Eagleton himself. He's traced us here."

She didn't say anything for a moment. Beyond the double-paned windows the jet-black night of Mars seemed to crowd in even closer around them, chilling the room. Dorothy got out of bed and

walked, nude, across the cold floor and pulled an old robe from the closet. She slipped it on, belted it, and sat down in Barney's lap. She was shaking slightly—but not from the cold.

"What are we going to do, Barney?"

"I don't know. Keep running, I guess. Hope we can get a ship to Earth before they catch up with us."

"We run and run from them, but every time we look back they're still there. It's like they know every move before we make it. Do you think we can get away from them even on Earth?" Her soft voice cracked on the last word as a sob escaped from deep in her chest.

"I don't know. I DON'T KNOW! I had no right dragging you into this. A month ago you were free and happy. A month ago you were on your way to a future as some miner's wife. Now you're nothing but a hunted animal—just like me."

"A month ago I didn't have you. Good or bad, hunted or not, you're it. I found you, and I'm not letting you go. Like it or not, buster, you're stuck with me!"

"Very funny. A month ago you didn't know what it was going to be like. A month ago you didn't even know the jewel existed."

"If that damn jewel bothers you so much—if you're so worried about what might happen to us because of it—why not give it up? Is it worth your life?"

"With it we could live like kings."

"Dead kings. Besides, who ever heard of a female king?"

"But, damnit, it's mine. It belongs to me! Why should I let someone take it away from me?"

Dorothy sat up and listened intently, her head cocked to one side. Under her Barney's body stiffened, his muscles preparing for action.

"I hear water boiling over," Dorothy said with a smile. "Come on, I'll pour." The breath whoshed out of Barney's lungs as he relaxed, then he got unsteadily to his feet as Dorothy stood up.

They went into the kitchen and while they were drinking the hot black coffee, made from real beans imported from Earth, Barney told her what had happened that night, leaving out only the reason he had gone out to start with. Not telling her of his wild plan to possibly steal a ship capable of getting to Earth. It was such a farfetched plan that even a space-neophyte such as Dorothy would have laughed at his foolhardiness.

"Eagleton," she said bitterly, as if the very name left a bad taste in her mouth. "He'll haunt us all our lives."

"Not if we can get rid of the jewel." Barney unbuttoned his shirt and took the

leather pouch from around his neck. He unwrapped the oilskin packet on the table. The stone was as big as the last joint on his thumb and a brilliant, burning red.

It was a flame jewel, flawless, perfect, so deep you could look down inside and see your soul. It weighed over a hundred carats, and was only the eighth ever discovered. Unnatural, not made by man but made by something outside of nature, millions of years ago. Earth science still had no idea of what conditions could even produce such an artifact, had yet to find a way to even effect it. Even the heat of a thermonuclear torch, the sun-hot plasma jet held but tenuously by a magnetic bottle, open at one end, could not raise the temperature of a flame jewel one-hundredth of one degree.

Dorothy stared. "And can you imagine? Someone gave it to you."

"He should have given me the plague. It would have been a lot less trouble."

The whole thing was like finding the rainbow's end or the fabled lost city of the Martain ancients. Barney had been running a space-rescue team out around Saturn, pulling ice-miners out of the rings when they managed to get holed by a chunk of ice IV moving at a hundred kilometers a second or so. He had pulled one old rock-rat out long after he should have been dead, half-frozen and almost a vegetable from lack of oxygen. He was half out of his head, and he had tried to give Barney the stone for saving his life.

Barney hadn't intended to accept it, but in the hospital back on Eleven the prospector had gone into a coma and died, a records check showed no living relatives, and the court decided that the stone was legally Barney's. The newscasts throughout the belt and moons had carried it big for a couple of days, and before the week was out Barney had three offers for the stone. One of them was from Eagleton. Like the others, he was one of the entrepreneurs who had gravitated out to Mars and beyond, where their business talents would not be restricted by the multiple volumes of laws Earth had passed against free enterprise, but his offer was far short of what Barney thought the stone was worth. When Eagleton began to get hard-nosed about buying the stone, Barney suggested that he take a walk out on the surface—without his suit.

That night they took Barney on one of the lower levels and worked him over with pieces of pipe. The next day, in the hospital, Barney got a note asking him



if he had reconsidered Eagleton's offer. He ran.

It was, he now thought, a stupid thing to do. There wasn't much in the way of law outside of Earth's orbit, and a smarter man would have given Eagleton the stone and walked away—in one piece—but Barney had some ideas about spending his declining years living in the manner to which he wanted to become accustomed, relaxing on the Riviera, instead of daily risking his life in the belt or on Jue's moons or out in the rings. He thought he would be safe on Mars until he could get a ship to Earth, but, as it turned out, nothing had changed. They came after him, and the only offer Eagleton was now making was a cut from a laser pistol.

So, what do we do now?" Dorothy asked.

"I'm about to convince myself that it's better to be a little rich than very, very dead."

"Meaning?"

"Meaning that I'm going to sell it to Rotsler."

"For a lousy half-a-million dollars?"
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Barney knew that with the jewel and Dorothy he would be able to live in luxury and happiness—once he figured out a way to stay alive.

SKYLAB

Skylab soon will take the "stunt" out of spaceflight, and make it a purely practical research program of value to all of us.

article/Jack Jardine

PETE CONRAD: *"In the area of Skylab right now, which leads on to the shuttle, we're gonna study the sun. The sun is probably the most efficient furnace that anybody ever built. And we're facing an energy crisis, and we've gotta understand more of the sun. The instrument that we have on board allows us to study the sun in a manner which we can't do down here on the ground. Some of these instruments only work in the vacuum of space."*

The name "Skylab" fairly well describes its functions. If you stretch your definitions, Skylab might even be thought of as a space station. It's bigger than an Apollo command module—part of it is a Multiple Docking Adaptor which would allow simultaneous docking of two Apollo command modules—but considerably smaller than the familiar space station of Clarke and Kubrick. During its first month of orbital life it will carry astronaut Conrad and two companions more than 11 million miles at an altitude of 235 nautical miles (435

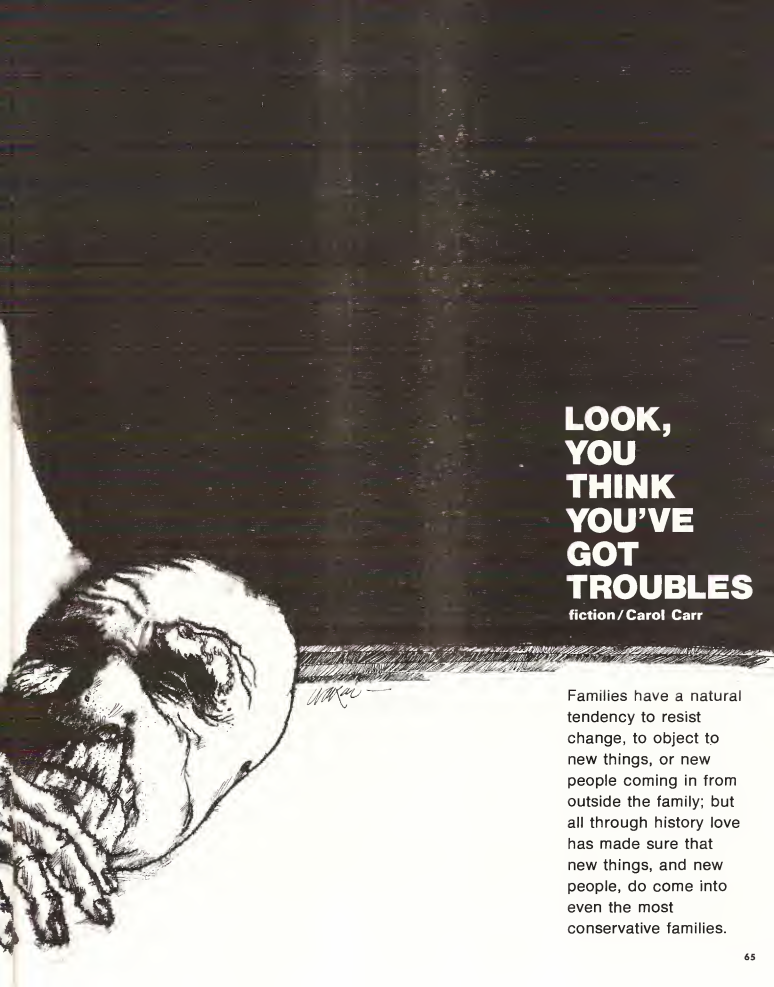
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The Skylab will be a 10,000 cubic foot workshop in orbit, 48 feet long and 21 feet in diameter, with room for more than 60 separate experiment programs.







LOOK, YOU THINK YOU'VE GOT TROUBLES

fiction/Carol Carr

Families have a natural tendency to resist change, to object to new things, or new people coming in from outside the family; but all through history love has made sure that new things, and new people, do come into even the most conservative families.

Tell you the truth, in the old days we would have sat shivah for the whole week. My so-called daughter gets married, my own flesh and blood, and not only he doesn't look Jewish, he's not even human.

"Papa," she says to me, two seconds after I refuse to speak to her again in my entire life, "if you know him you'll love him, I promise." So what can I answer—the truth, like I always tell her: "If I know him I'll vomit, that's how he affects me. I can help it? He makes me want to throw up on him."

With silk gloves you have to handle the girl, just like her mother. I tell her what I feel, from the heart, and right away her face collapses into a hundred cracks and water from the Atlantic Ocean makes a soggy mess out of her paper sheath. And that's how I remember her after six months—standing in front of me, sopping wet from the tears and making me feel like a monster—me—when all the time it's her you-should-excuse-the-expression husband who's the monster.

After she's gone to live with him (new Horizon Village, Crag City, Mars), I try to tell myself it's not me who has to—how can I put it?—deal with him intimately; if she can stand it, why should I complain? It's not like I need somebody to carry on the business; my business is to enjoy myself in my retirement. But who can enjoy? Sadie doesn't leave me alone for a minute. She calls me a criminal, a worthless no-good with gallstones for a heart.

"Hector, where's your brains?" she says, having finally given up on my emotions. I can't answer her. I just lost my daughter, I should worry about my brains, too? I'm silent as the grave. I can't eat a thing. I'm empty—drained. It's as though I'm waiting for something to happen but I don't know what. I sit in a chair that folds me up like a bee in a flower and rocks me to sleep with electronic rhythms when I feel like sleeping, but who can sleep? I look at my wife and I see Lady Macbeth. Once I caught her whistling as she pushed the button for her bath. I fixed her with a look like an icicle tipped with arsenic.

"What are you so happy about? Thinking of your grandchildren with the twelve toes?"

She doesn't flinch. An iron woman.

When I close my eyes, which is rarely, I see our daughter when she was fourteen years old, with skin just beginning to go pimply and no expression yet on her face. I see her walking up to Sadie and asking her what she should do with

her life now she's filling out, and my darling Sadie, my life's mate, telling her why not marry a freak; you got to be a beauty to find a man here, but on Mars you shouldn't know from so many fish. "I knew I could count on you, Mama," she says, and goes ahead and marries a plant with legs.

Things go on like this—impossible—for months. I lose twenty pounds, my nerves, three teeth and I'm on the verge of losing Sadie, when one day the malchute goes ding-dong and it's a letter from my late daughter. I take it by the tips of two fingers and bring it into where my wife is punching ingredients for the gravy I won't eat tonight.

"It's a communication from one of your relatives."

"Oh-oh-oh." My wife makes a grab for it, meanwhile punching CREAM-TOMATO-SAUCE-BEEF DRIPPINGS. No wonder I have no appetite.

"I'll give it to you on one condition only," I tell her, holding it out of her trembling reach. "Take it into the bedroom and read it to yourself. Don't even move your lips for once; I don't want to know. If she's God forbid dead, I'll send him a sympathy card."

Sadie has a variety of expressions but the one thing they have in common is they all wish me misfortune in my present and future life.

While she's reading the letter I find suddenly I have nothing to do. The magazines I read already. Breakfast I ate (like a bird). I'm all dressed to go out if I felt like, but there's nothing outside I don't have inside. Frankly, I don't feel like myself—I'm nervous. I say a lot of things I don't really intend and now maybe this letter comes to tell me I've got to pay for my meanness. Maybe she got sick up there; God knows what they eat, the kind of water they drink, the creatures they run around with. Not wanting to think about it too much, I go over to my chair and turn it on to brisk massage. It doesn't take long till I'm dreaming (fitfully).

I'm someplace surrounded by sand, sitting in a baby's crib and bouncing a diapered kangaroo on my knee. It gurgles up at me and calls me grandpa and I don't know what I should do. I don't want to hurt its feelings, but if I'm a grandpa to a kangaroo, I want no part of it; I only want it should go away. I pull out a dime from my pocket and put it into its pouch. The pouch is full of tiny insects which bite my fingers. I wake up in a sweat.

"Sadie! Are you reading, or rearranging the sentences? Bring it in here and

I'll see what she wants. If it's a divorce, I know a lawyer."

Sadie comes into the room with her I-told-you-so waddle and gives me a small wet kiss on the cheek—a gold star for acting like a mensch. So I start to read it, in a loud monotone so she shouldn't get the impression I give a damn:

"Dear Daddy, I'm sorry for not writing sooner. I suppose I wanted to give you a chance to simmer down first." (Ingrate! Does the sun simmer down?) "I know it would have been inconvenient for you to come to the wedding, but Mor and I hoped you would maybe send us a letter just to let us know you're okay and still love me, in spite of everything."

Right at this point I feel a hot sigh followed by a short but wrenching moan.

"Sadie, get away from my neck. I'm warning you . . ."

Her eyes are going flick-a-fleck over my shoulder, from the piece of paper I'm holding to my face, back to the page, flick-a-fleck, flick-a-fleck.

"All right, already," she shoo-shoes me. "I read it, I know what's in it. Now it's your turn to see what kind of a lousy father you turned out to be." And she waddles back into the bedroom, shutting the door extra careful, like she's handling a piece of snow-white velvet.

When I'm certain she's gone, I sit myself down on the slab of woven dentel floss my wife calls a couch and press a button on the arm that reads SEMI-CL.: FELDMAN TO FRIML. The music starts to slither out from the speaker under my left armpit. The right speaker is dead and buried and the long narrow one at the base years ago got drowned from the dog, who to this day hasn't learned to control himself when he hears "Desert Song."

This time I'm lucky; it's a piece by Feldman that comes on. I continue to read, calmed by the music.

"I might as well get to the point, Papa, because for all I know you're so mad you tore up this letter without even reading it. The point is that Mor and I are going to have a baby. Please, please don't throw this into the disintegrator. It's due in July, which gives you over three months to plan the trip up here. We have a lovely house, with a guest room that you and Mama can stay in for as long as you want."

I have to stop here to interject a couple of questions, since my daughter never had a head for logic and it's my strong point.

First of all, if she were in front of me in person right now I would ask right

off what means "Mor and I are going to have a baby." Which? Or both? The second thing is, when she refers to it as "it" is she being literal or just uncertain? And just one more thing and then I'm through for good: Just how lovely can a guest room be that has all the air piped in and you can't even see the sky or take a walk on the grass because there is no grass, only simulated this and substituted that?

All the above notwithstanding, I continue to read:

"By the way, Papa, there's something I'm not sure you understand. Mor, you may or may not know, is as human as you and me, in all the important ways—and frankly a bit more intelligent."

I put down the letter for a minute just to give the goose-bumps a chance to fly

decide I might as well relax. I close my eyes and try to think of what the first meeting will be like.

"How." I put up my right hand in a gesture of friendship and trust. I reach into my pocket and offer him beads.

But even in my mind he looks at me blank, his naked pink antennas waving in the breeze like a worm's underwear. Then I realize there isn't any breeze where we're going. So they stop waving and wilt.

I look around in my mind. We're alone, the two of us, in the middle of a vast plain, me in my business suit and him in his green skin. The scene looks familiar, like something I had experienced, or read about. . . . "We'll meet at Philippi," I think, and stab him with my sword.

“ . . . a girl needs her father, and what kind of man is it who can't sacrifice his personal feelings for his only daughter? Always I stand ready to help my family.”

out of my stomach ulcers before I go on with her love and best and kisses and hopes for seeing us soon, Lorinda.

I don't know how she manages it, but the second I'm finished, Sadie is out of the bedroom and breathing hard.

"Well, do I start packing or do I start packing? And when I start packing, do I pack for us or do I pack for me?"

"Never. I should die three thousand deaths, each one with a worse prognosis."

It's a shame a company like Interplanetary Aviation can't afford, with the fares they charge, to give you a comfortable seat. Don't ask how I ever got there in the first place. Ask my wife—she's the one with the mouth. First of all, they only allow you three pounds of luggage, which if you're only bringing clothes is plenty, but we had a few gifts with us. We were only planning to stay a few days and to sublet the house was Sadie's idea, not mine.

The whole trip was supposed to take a month, each way. This is one reason Sadie thought it was impractical to stay for the weekend and then go home, which was the condition on which I'd agreed to go.

But now that we're on our way, I

Only then am I able to catch a few winks.

The month goes by. When I begin to think I'll never remember how to use a fork, the loudspeaker is turned on and I hear this very smooth, modulated voice, the tranquilized tones of a psychiatrist sucking glycerine, telling us it's just about over, and we should expect a slight jolt upon landing.

That slight jolt starts my life going by so fast I'm missing all the good parts. But finally the ship is still and all you can hear are the wheezes and sighs of the engines—the sounds remind me of Sadie when she's winding down from a good argument. I look around. Everybody is very white. Sadie's five fingers are around my upper arm like a tourniquet.

"We're here," I tell her. "Do I get a hacksaw or can you manage it yourself?"

"Oh, my goodness." She loosens her grip. She really looks a mess—completely pale, not blinking, not even nagging.

I take her by the arm and steer her into customs. All the time I feel that she's a big piece of unwilling luggage I'm smuggling in. There's no cooperation at all in her feet and her eyes are going every which way.

"Sadie, shape up!"

"If you had a little more curiosity about the world you'd be a better person," she says tolerantly.

While we're waiting to be processed by a creature in a suit like ours who surprises me by talking English, I sneak a quick look around.

It's funny. If I didn't know where we are I'd think we're in the back yard. The ground stretches out pure green, and it's only from the leaflet they give you in the ship to keep your mind off the panic that I know it's 100% Acrispian we're looking at, not grass. The air we're getting smells good, too, like fresh-cut flowers, but not too sweet.

By the time I've had a good look and a breathe, what's-its-name is handing us back our passports with a button that says to keep Mars beautiful don't litter.

I won't tell you about the troubles we had getting to the house, or the misunderstanding about the tip, because to be honest I wasn't paying attention. But we do manage to make it to the right door, and considering that the visit was a surprise, I didn't really expect they would meet us at the airport. My daughter must have been peeking, though, because she's in front of us even before we have a chance to knock.

"Mother!" she says, looking very round in the stomach. She hugs and kisses Sadie, who starts bawling. Five minutes later, when they're out of the clinic, Lorinda turns to me, a little nervous.

You can say a lot of things about me, but basically I'm a warm person, and we're about to be guests in this house, even if she is a stranger to me. I shake her hand.

"Is he home, or is he out in the back yard, growing new leaves?"

Her face (or what I can see of it through the climate adapter) crumbles a little at the chin line, but she straightens it out and puts her hand on my shoulder.

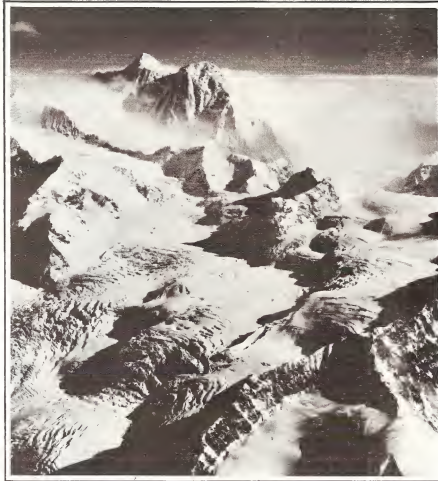
"Mor had to go out, Daddy—something important came up—but he should be back in an hour or so. Come on, let's go inside."

Actually there's nothing too crazy about the house, or even interesting. It has walls, a floor and a roof, I'm glad to see, even a few relaxer chairs, and after the trip we just had, I sit down and relax. I notice my daughter is having a little trouble looking me straight in the face, which is only as it should be, and it isn't long before she and Sadie are discussing pregnancy, gravitational ex-

(turn to page 80)

THE NEXT DROP YOU DRINK

from page 27



Glaciers such as this one on Mount Hayes in the Alaska range hold over one percent of the *total* water supply of the globe locked in ice, waiting to be melted to feed man's ever increasing need for fresh, clean water. Without such new water supplies it is doubtful if our current rate of technological expansion can be maintained.

Human blood has a striking similitude to seawater—an evolutionary holdover from the dim past when all life was borne by the ocean—and yet, seawater is poisonous: more than a pint is usually fatal. A man cannot survive longer than a week and a half without water. Conversely, people have literally drunk themselves to death, flooding their kidneys with water until they burst.

The delicate balance between man and water is further complicated by the quality of the water—specifically, the amount of solid material dissolved in the liquid. Humans have a tolerance of about 500 solid particles per million of water (500 ppm), though some animals can ingest higher concentrations. Solids in water can vary enormously, from metallic compounds and organic substances, to the familiar sodium chloride found everywhere in the Earth's seas. Even rainfall is hardly pure, containing from 2.3 to 4.6 ppm. Which means that during a typical weekend downpour, a ton of solid matter is falling on every square mile of land.

When it is not actively engaged in

soaking everything in sight, nearly all the water on the planet is in the seas: about 97.2 per cent is in this saline state, while another 2.15 per cent is frozen into the polar icecaps and glaciers. And nine out of every ten gallons of what is left over is groundwater, locked away from the immediate reach of man. The final gallon goes to make up the rivers, streams, lakes and clouds.

That single gallon can scarcely go very far toward meeting the increasing global demand for fresh water, though the experts concede that even this primary resource is not being managed well. The reasons for this are numerous, ranging from plain ignorance to playing politics.

The Amazon River, for instance, was assumed for decades to have a freshwater flow much lower than is known now, simply because, until 1963, nobody had bothered to measure the river. The result threw hundreds of calculations off. Another reason is accessibility: not all water is conveniently located. Barriers like national boundaries can hinder distribution.

This last instance goes to explain why the United States is short of water while Canada has hundreds of times too much. Indeed, the combined Canadian provinces have an estimated one-third of the entire terrestrial fresh water reserves. Currently, none is piped south of the border, though American need may force a change. Abel Wolman, Past President of the American Water Works Association bluntly stated not long ago: "It is very interesting that, although it isn't mentioned too much publicly, because politically it is not the time to do so, the transmission of Canadian waters to the U.S. is inevitable."

Until then, thirsty Americans are experimenting with a number of drilling schemes designed to tap the groundwater trapped in shales and other rock formations deep in the crust of the Earth. So far, technology hasn't proved up to the complex double task of first wringing the moisture from the rocks like a damp sponge, and then pumping it to the surface.

Because the oceans extend over three-quarters the way around the surface of the Earth, and hold some 370 billion billion gallons, they are quite naturally seen as the ultimate answer to the looming water shortage. The catch is, of course, figuring out a cheap process of extracting the salt which makes seawater undrinkable. Salt concentration in seawater runs as high as 3500 ppm, and this high density necessarily forces the

use of much power, and so saves us the price of the product.

Since its creation in 1950, the US Office of Saline Waters has had remarkable success transforming what was once considered a strictly science-fictional concept into a working reality in two short decades. Those twenty years of research have enabled the cost of desalinated water to fall from ten dollars per thousand gallons to around one dollar per thousand. Based on design principles pioneered by the OSW, private industry has erected several dozen desalination plants in areas where the need for fresh water is critical: Israel and the Middle East, islands in the Caribbean and the South Pacific, and in the American Southwest, where they are used to clean brackish well waters.

Because the demand for fresh water was so urgent, the discrepancy in production costs between desalted water and water from other sources was ignored. When these somewhat special applications are set aside, the fact remains that desalted water is still one hundred times as expensive as ordinary tap water.

The problem here is twofold, involving both the esoteric chemical nature of salt and the practical considerations of energy prices. When dissolved in water, salt separates into charged particles called ions, which exhibit a remarkable affinity for water molecules; each ion bonds to itself a shell of water molecules so firmly that massive doses of power are required to sever those links. Once the ties between ion and water molecule are undone, fresh water is the result—but the energy required to do so is fearsome.

It is the cost of providing this energy that drives up the price of distilled water to the current mark. Experts examining this end of the problem calculate that the introduction of cheap electrical power via the hydrogen-fusion technique, coupled with the optimum in desalination technology, could lower the price tag by nineteen-twentieths. However, they also admit that this is a goal centuries distant, and the cost per gallon would still be five times as high as tap water is today.

Above the continents and the oceans is the atmosphere. The skies contain water in the form of vapor that is visible only when either partially condensed into clouds, or fully condensed as precipitation. Even though water vapor constitutes just two per cent of the total atmosphere, it's considered an excellent candidate for new fresh water sources.

A short story by Robert Silverberg suggested an intriguing method of col-

lecting some of this atmospheric moisture. He envisioned a factory which condensed water out of the atmosphere the same way an ice-cold glass does on a humid summer afternoon—but operating on a much larger scale! This notion is appealing because it bypasses the numerous messy processes required in desalination or treatment facilities today.

Unfortunately, the technology to construct such an extraction plant is at least several decades away, though perhaps the first rudimentary steps toward it have been inadvertently taken by French pollution-control engineers in Paris this year. To help combat the smog that now befouls the City of Light, they installed two gigantic vacuum cleaners that suck in vast quantities of dirty Parisian air and run it through a series of filters before returning it to the boulevards. In one cleaning step, a small quantity of liquid water is separated out of the air.

Not so far in the future is the harnessing of aerial moisture by creating and controlling the rain. Even though the amount of water vapor in the atmosphere at any point in time is somewhat negligible by oceanic standards, the total turnover rate is only a couple of weeks long. This means that the air mass over any particular body of land may be "rained out" and turn dry, but more vapor is constantly evaporating from seas and lakes to replace it. The cycle of supply never stops. The trouble is that the rain doesn't always fall where we want it.

The rather chancy art of rain-making has grown up to counter that. Some spectacular successes have been claimed by rainmakers: a private outfit apparently ended the great New York City drought in the late 1940s, and in the Vietnam War, the US Air Force has used thousands of rainmaking rockets to dampen more than the spirits of Viet Cong battalions on numerous occasions. In recent years, water-short Israel has mounted a government-sponsored program to tap the potential of winter storms for irrigation purposes. After almost five years, they reported a fifteen per cent gain in overall precipitation using airborne generators that spray a fine mist of silver iodide into likely-looking clouds. The silver iodide acts to cause droplets to form out of the concentrated vapor in a cloud. An alternate method, favored by the Soviets, employs carbon dioxide crystals fired from cannons into cumulus clouds hanging low to the ground.

Despite the encouraging results cited

above, scientific rain-making is still not reliable. For instance, seven years of intensive cloud-seeding in the Santa Catalina Mountains in Arizona were especially discouraging. The final results showed no appreciable rainfall increase; in fact, less rain fell on seeded days, perhaps causing project officials to echo Charles Darwin's feelings of frustration when he wrote: "all nature is perverse and will hot do as I wish it."

Probably the increasing use of computers and TV-equipped satellites, together with ongoing research into cloud-seeding techniques, will turn rain-making into a routine industry capable of meeting part of the world's fresh water needs. The final solution must be the direct control of the weather itself, altering the basic mechanism that distributes wind and water vapor over the Earth to suit men's wishes. Ideally, then, rainfall that otherwise goes to waste—falling at sea or on inaccessible land—would be diverted for useful purposes, like breaking a centuries-long desert drought, or filling an empty city reservoir. But terrestrial weather conditions are tied to fluctuations in the sun's atmosphere, a factor that would have to be taken into account before initiating large-scale modification here. Complete control of the weather dictates some form of tinkering with the solar surface, a prospect even the most reckless optimists admit is not going to come about soon.

The last new source of water is more immediate. It is ourselves.

The industrialized nations, and even many of the agricultural countries, have been almost criminally profligate and irresponsible with their natural water supplies. Of the immense amounts of fresh water that farms and factories consume, very little is actually integrated into the final product, be it either digital AM-FM clock radios or lima beans. Virtually all the millions of gallons are "lost" by evaporation, seepage or contamination.

There is room for improvement. Heavy industry reuses only a small fraction of the fresh water it purchases daily at cut-rate prices, but hydrologists foresee this figure raised for four-fifths by the end of the century in America and Europe. Certain forms of agriculture which use enormous quantities of fresh water measured against the crop's protein yield may be phased out in favor of less demanding varieties. The classic example is rice, a vegetable seemingly doomed to be replaced by wheat in many nations that simply cannot afford to

One of the most critical and least publicized future needs of mankind is the need for new water supplies to keep civilization going.

spare the extra fresh water needed for rice paddies. India, for example, reaching for industrial status, has cut rice production while drastically increasing wheat plantings. The net gain in fresh water is piped into new steel mills.

Even these drastic measures may not be sufficient by the 1990s, when demographers predict the real population crunch will start to be felt. To meet that crisis, many agriculture officials are counting on that old science fiction writer's standby: hydroponics.

The idea of growing plants without soil remained a laboratory stunt until a decade ago when Japanese farmers started full-scale hydroponics operations. They found that yields were excellent, but the fresh water requirements were prodigious. Recently, Atomic Energy Commission researchers discovered that some vegetable seedlings could be started on fresh water and then weaned to pure seawater, saving an estimated three-quarters of the fresh water used by the Japanese farmer. Now the AEC is trying to find a way to grow the same vegetables on nothing but seawater from the start.

Treating sewage to render it drinkable, a process devised for use on long space voyages, is also under serious investigation as to earthbound applications. Though the thought of drinking one's own wastes is hardly enticing, chemists working on the process claim that the water produced not only tastes fine, but is a good bit safer than the stuff the Water Company bills you for. At the present time, research is concentrated on two variations of the sewage-treatment principle. In the first, sewage is passed through a solution that breaks down the large organic molecules. This done, the smaller molecules are absorbed in banks of activated charcoal filters until the water is absolutely pure. A slightly more exotic method uses a Cobalt-60 source to kill coliform bacteria and a host of other viruses without itself radioactively contaminating the water, which is pumped down a series of chemical "scrubbing" agents and another bank of filters. The result: pure drinkable water.

When all the new sources of water have been tapped, another problem presents itself. Where does all that water go? Fresh water storage is not quite so simple as the average person's mental image of a pleasant reservoir backed by a shining white concrete dam.

Reservoirs themselves are troublesome. They take up much land, usually valuable land around cities and suburbs,

and have little to offer besides miles of water. A typical example of the relationship between cities and their reservoirs might be Rochester, a medium-sized city in upstate New York. To service the city and its ring of suburbs, the local Water Authority maintains a chain of pumping stations, storage tanks and pipelines to Hemlock Lake, the central reservoir for Rochester. The entire lake, some eleven miles in length, is nothing but reservoir.

In order to insure water purity, the Authority has banned all swimming, motor boating and the construction of lakeside cottages. The reservoir waters are unsullied, but their recreation value is slight. From the standpoint of a city resident interested in escaping the mid-summer heat and getting in a little water-skiing or skin-diving, Hemlock Lake might just as well be located on the far side of the Moon.

This basic conflict of interests between water utilities and recreationists is bound to worsen as the need for more water, and more water storage space increases. Most of the natural sites for reservoirs are already in use, forcing utilities to consider areas once thought either inappropriate or unsuitable for water storage. New York City has been pushing hard for permission to erect a holding facility atop Storm King Mountain, one of the last scenic spots on the Hudson; likewise, Los Angeles has built several reservoirs perilously near the San Andreas fault line. One of the restraining dams almost split open during an earth tremor two years ago, causing thousands of homes to be evacuated.

Water authorities around the world are discovering that their dams are vulnerable to more than just 'quakes. Silt washed downstream tends to pile up behind the dam walls, reducing their storage capacity. The flat, unruined surface of any reservoir also encourages enormously increased rates of evaporation by run and wind action: over fifteen billion cubic meters annually from the Lake Nasser reservoir backed by Egypt's Aswan High Dam.

Quiet tropical reservoirs form an excellent medium for the extensive growth of waterweed, already acknowledged as a major ecological problem of this century. A variety of the Japanese water hyacinth, this malevolent plant is currently at work choking shut most rivers, lakes and reservoirs in South America, Africa, Southeast Asia and even sections of Australia. Dams clog with it, water transport thrashes to a stop, and all the while billions of gallons of fresh water

go skyward in the form of vapor transpired by the waterweed's pretty pink flowers or intertwined leaves. No effective antidote to waterweed—chemicals, machines, fish or bugs—is known to exist.

Restrictions, location, evaporation, silt and waterweeds. Combined, they pose a formidable challenge to the traditional concept of water storage. Considered in this light, Professor Issacs's concept looks much more attractive than it did at first.

The iceberg proposal presents a completely enclosed compact reservoir of pure soft water available anywhere there's a seacoast. Once the towing was over, melting down the ice, using the residue heat from an atomic power reactor, would be a fairly simple task. Since fresh water floats on salt water without appreciable mixing, something like an oversize swimming-pool skimmer would sweep up the fresh water and rapidly pump it ashore via flexible pipelines.

An iceberg moored off a city having a warm climate, such as Los Angeles, could provide more than simply plentiful water. The very chilliness of the water could cheaply air-condition nearby homes and offices. And the newly-lowered temperature gradient of the sea around the ice might attract to the coast schools of fish that otherwise prefer the cooler depths of the ocean.

Recreation in Southern California would be enhanced by an iceberg. While it melted, the ice could support a spectrum of sports most Los Angeles have never tried: skiing, snowmobiling, outdoor ice-skating and even tobogganing. Ski lodges and lifts, set into place by helicopters, could be used and enjoyed until the ice shrank to sea level, whereupon this portable version of Aspen would be airlifted to the replacement 'berg and returned to business. This would create a skier's paradise, a continuous supply of brand new slopes all year 'round, only ten minutes from the Harbor Freeway.

Once the technology of iceberg melting was mastered, engineers might figure a way to reverse the process and make permanent floating icebergs. Conceivably, Los Angeles might someday host the Winter Olympics, secure in the knowledge that at the conclusion of the competition all the facilities—ski-runs, sled courses, rinks and grandstands—could be melted down and piped into the municipal water system, and change the phrase, "sharing in the Olympic spirit," from an empty bit of rhetoric into something quite real. **O**

THREE TINKS ON THE HOUSE

from page 33

hoped Anstruther was only a would-be daddy-boy and not something else.

"You know?" said Anstruther. "They had tink over in Britain and Europe for years, before most of us here ever heard of it. Say, I might as well have another one." He pushed forward his card and money. Joe obliged him. Anstruther, I saw, still didn't get the extra drop.

"Anyway," he went on, "I think the administration made a good compromise, legalizing only the liquid form. Makes it a lot easier to control."

"Hell," said Artie Rail, "all they wanted was to get reelected, just like always. Any campaign's a snow job; what makes this year any different?"

Well, who could argue? Give one side a little, but not enough to groch the other side. That's politics and always will be.

The phone chimed. Anstruther stood and moved to the bar. Joe picked up the handpiece, listened, and handed it over. He faced the console piece toward the other man. By habit, the visual was off; someone at the other end was saving money on the call.

"Yes?" said Anstruther. "I'll be right over." He came back to the table and gulped his second tink, which is not a good idea. Then he bolted out.

Hollis smiled. "That guy has a point. Who would have figured that when pot got legal, we'd be drinking it instead of smoking it?"

I wished he hadn't said that. I still miss tobacco. Not enough to bootleg it, though. Then I relaxed, beginning to stone-up from the tink. It is nice, once in a while. It was a little while before I started to listen again.

Artie was off and running, about his kid, this time. "They're trying to turn the boy queer or something, in their schools," he said. "Other day I caught him and his buddy—you wouldn't believe it! And he had the bowels to sell by his own father..."

I didn't bother to argue. I had my own misgivings to argue with, and I wished I knew which side of me was right.

When I tuned in again, Artie was still going. "And you know what else? He asked, did I rather he went and got his sterilization bonus? At his age? Hell, I want grandchildren, like anybody else." He grinned, looking uneasy. "Not too many, o' course. But, freakin' Jeez—one, anyway. I believe Zero Population Growth, but not Zero Population."

Nobody answered Artie; he didn't ask questions that had good answers. He

went back to creebing about his car; every place he wanted to go, the routes were more and more coded-out against him. Green code routes, no restrictions, were getting hard to come by.

So what else was top-line news? I could see the handwriting on the wall, too. The only difference between Artie and me was that I believed it meant what it said.

The door to the front swung open; it was Anstruther again. The blast we caught from the TV-juke was *Lefly and the Seven Feeps*, striding on "Up Your Taxes."

"Tink and soda," he said, waving his card. This time he didn't sit with us, but climbed onto the nearest barstool. "Yes, I know," he said, "last for the day." Joe nodded; he hadn't argued. "But fitting, you know," the man continued. "Very fitting."

"Yeh?" said Hollis MacIlwain. "What fits it so nice?"

Anstruther didn't answer right away. He sipped on his tink while Artie began on the next chapter of how the whole damn world wasn't set up to his personal tastes. I can listen to that all night without ever hearing much of it. Not that I hang in at Joe's that heavy; I wasn't even late home for dinner yet.

Anstruther raised his glass. "Three tinks," he said, "and three—"

"And three what?" Hollis said. Anstruther didn't say anything. I got a hunch.

"Three, uh—kids, maybe?" I said. "Three kids, you have?"

Whatever Anstruther wanted to say, it wouldn't come out. He tried to shake his head, but all it did was wobble a little.

"Three kids," said Artie Rail. For once, he wasn't whining. "You God-damn breeder!"

"All right, three kids!" Anstruther blurted. He pulled his head up, sat straight. "It's not a crime. Not yet..." True, but still... Then he threw it. "And maybe we'll have another, too, if we happen to want to!"

Silence. Then the sound of chairs being pushed back. Joe was the first to say up. "Whatever you do, do it outside!"

I didn't really feel like it, being stoned, and I don't suppose Hollis did, either. But it was too much. Anstruther hadn't made an apology, much less an excuse, and then he'd said maybe he'd do it again. Hollis got him by the neck and one arm; I had the other arm. We took him out the back way, to the alley.

We used to say "Up against the wall,"

and Anstruther sure as hell was. But he didn't fight, or even try to. All he said was, "Not all three of you, for God's sakes!" That was fine with Hollis and me; we stepped back. And Anstruther did get his hands up, looking fairly competent.

Still it was no fair fight; Artie was Golden Gloves, once. He faked Anstruther's hands high and slammed him in the gut, then threw his hard one.

Anstruther's head cracked back against the bricks; he collapsed. Artie knelt beside him. "Jeez; I didn't mean to kill the bastard. Just to show him how the cow ate the cabbage." Artie looked scared. "You think he's all right?"

The man was still breathing; Artie relaxed a little. Hollis was looking into Anstruther's wallet; he showed it to Artie and me, then stuffed it back into the man's pocket.

"We might as well go back in," he said.

Inside, on our table, three tinks were set up. Our usuals, on the house and no cards punched. Joe had one, too. We all drank a little off the top. I don't think anybody thought it was a toast.

"Call an ambulance for that guy," said Hollis.

"Sure thing," said Joe. "In about an hour."

"No," said Artie. "Now. We did wrong on him."

"What the hell you mean?" said Joe.

Artie sure as hell didn't like to have to say it. "He has a ZPG card. Sterilization bonus, a little over a year ago."

"Bullshit!" Joe said. "His wife just had her kid, today."

"Yeh, sure," I said. "But whose?"

"Jesus! No wonder he—" Joe didn't finish it.

You don't waste a tink; we drank them, then left before the ambulance could get there. It's one thing to admit you screwed up, and something else to stay around and pay for it. Tough world, little brother.

South was blue again; I got home before my warmed-over dinner was too tired to eat.

Marise and Les were both out someplace. I didn't feel much like talking.

"Anything special happen today?" Linda asked.

I thought about it. "Well, yes. Joe at the Stoneboat set up three tinks on the house." O

1-5



fiction/Edward Wellen

art/Alicia Austin



Through the decades he waited
... waited for the day when the
last great battle would be fought
for the Fatherland.

Barossa

The submarine rises slowly. The Commander stands on the hatchway ladder. He puts his hand on the hatch-securing wheel. Rust bites his palm and flakes away as he takes a firmer grip. From the hydrophone comes, "All clear." The submarine rises to ten fathoms. The Commander gives the order for release, "Surface!" Compressed air hisses into the tanks. The depth gauge in the conning tower starts moving; it accelerates. "Hatchway free!" shouts the chief engineer. "Pressure equalized."

Above and ahead, a rowboat with makeshift sail tattering itself on an oar jury-rigged as a mast rides low in the water. The outboard motor has long ago sputtered itself out. The people aboard forget to bail when the monster rips up through their wake.

Fear leaves their faces when they see the U-999 does not bear Cuban markings.

The Commander raises the conning-tower hatch and climbs out onto the bridge. The senior watch-officer follows, carrying a submachine gun.

Fresh air! The Commander's long beard streams in the spume like an oriflame.

The people in the rowboat gape at the Commander. When he lowers his nose they point toward Key West and smile and nod and jabber.

The Commander does not shift his gaze toward where they gesture. He is looking them over. They are three men, two of military age, one pushing sixty; a boy of thirteen; two women, one in her early twenties, the other in her late fifties; and a baby. The Commander lets the breeze carry his voice over his shoulder.

"Bring the two young men and the boy aboard."

It takes a boarding party to tear the three males from the others and across to the bridge of the U-999.

The Commander watches a petty officer shove the three through the hatchway. Now he has a full complement again. He strokes his beard. He has dyed the flowing white beard red. Barbarossa. In his youth he had learned the legend of the redbearded Emperor Frederick I, who sleeps in his Kyffhäuser mountain cave till he shall come forth to rescue Germany and make her chief of nations.

Without needing a word the boarding party seizes the refugee craft's spare jerricons of petrol and passes them down the conning-tower hatch. Fueling the U-999 is a standing problem. At least

now they will have hot meals for some time to come.

The two men and the boy stumble down the ladder. The foulness of the air smacks them at once, the scene waits for their eyes to adapt to the dim flicker.

The U-999 is not what she was. The damp causes vital electrical parts to fail. The woodwork has rotted badly. Condensation steadily drips down the bulkheads. Bunks and linen are always damp. Everything is black with diesel exhaust which, because the water pressure has grown too great for the exhaust valves, backs up. When he can spare the hands the Commander puts them to work on spit and polish but it is a losing battle. Just to keep the boat operating is enough to busy the crew. Not in a long while has the Commander given the order "Full speed ahead!" He knows the old engines cannot stand that strain for long.

By now the three refugees have seen the ratings lying on bunks. They look like corpses in the oily haze that fills this dank coffin. When they are not on watch the ratings, for the most part, simply lie on their bunks in a dead stupor. They are chained to the bunks; the chains lie neatly, as if the men have learned not to entangle their long fetters. Those of the crew in the engine room are worst off. They are always bathed in oil and sweat.

A petty officer jabs the three males aft into the engine room. He handcuffs them to pipes for now. Once the U-999 dives and shapes course there will be time to fit and weld the neck and leg irons in place.

The three hear a burst of submachine-gun fire outside the hull.

The Commander secures the hatch and climbs down into the control room. It is too bad about the women. But from the first he has made it a rule never to take the women aboard. It is hard enough to maintain discipline as it is. Woman's place is in church, in the kitchen, in the nursery. Not aboard a U-boat. As for the baby, if it had been a boy child he might have considered sparing it. He could have brought it up to serve in the crew one day.

One day. Der Tag. When will that come? What will happen when it comes?

Sometimes he forgets who he is and why he sails under the seas. But he is not mad. Give him time; it always comes back to him. He is Kapitän-Leutnant Helmut Niemans and he is waiting for

the Party to come again to power—to surface, as it were.

Meanwhile, he stays in hiding and watches the Amis and the Russiks play Chicken-of-the-Sea. He smiles in his beard thinking of Der Tag. One torpedo salvo fore and one aft; one for an Ami ship, one for a Russik. Each side will blame the other. Then it will all take up where it left off.

He was a mere twenty-two long ago in 1945. On Tuesday, May 1st, of that year, Hamburg radio announced that Adolf Hitler was dead. Grand Admiral Karl Doenitz took over as Der Fuehrer and began trying to arrange a surrender—to the Western Allies, but not to Russia. To show his good faith, Doenitz broadcast on the night of May 4th an order to every German warship to cease hostilities and return to port.

U-999 did not acknowledge the order.

It fought to break through to the open sea. It backed into its own wake to confound surface ships' detection devices. (The around-the-clock ping! ping! ping! of sound gear searching for submarines was enough to drive one mad!) It churned up knuckles of water with its propellers so that sonar-men heard a U-boat that wasn't there and chased after that. Finally, it shot flotsam (an officer's cap, escape lungs, life jackets, abandon-ship kits, planking, the top of a chart table, a jack-staff) through torpedo tubes. German Naval records carry the U-999 as "missing and probably sunk." But one day the U-999 will radio to Berlin in the old code that it is still here, still ready for action.

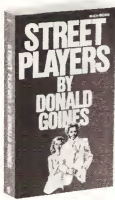
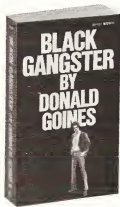
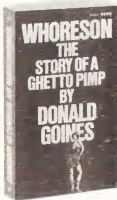
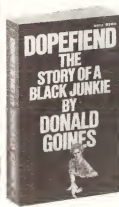
It has not been easy to keep the U-999 watertight and functional and the tin fish proud. The Commander is now in his eighties. All but 12 of his original crew of 55 have died. Some went naturally, some were shot trying to jump ship, others killed themselves. Once there was a near-mutiny, but he has put that out of his mind.

The 43 replacements are a motley lot. Few of them understand or speak German. He has had to teach them an international language of signs and kicks. It is like a little UN. He sighs. Yes, he has a full complement now, but he knows he will soon have to jettison the black cook. The hull of the U-999 has closed in on the man and he has the long stare. But that can wait. The Commander knows how to wait.

He gives the conn to his mate and goes to his quarters. He puts on a gramophone record and listens to the old songs that remind him of home. ○

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ALL THE SOUNDS OF THE RAINBOW

from page 23

into the tawdriest available vessel.

Marvin had never felt pressed so close to human beings in his life. He was both fascinated and repelled by the intimacy. And wondered what they were experiencing as him.

Then the universe of his senses went through another transformation. His mouth was filled with a spectrum of tastes that somehow spread themselves out along spacial dimensions: acrid spiciness like smoked chili peppers to the right, soft furriness of flat highballs to the left, off a way something like garlic and peptic gall, and everywhere the overwhelming taste of peppermint and melancholy red wine. He could hear the pounding of the surf now, but what he saw was a field of orange-red across which drifted occasional wisps of cool blue.

"Now join hands in a circle and feel outsides with your insides," said the plastic peppermint and musky red wine.

Marvin reached out with both hands. The right half of his body immediately became knotted with severe muscular tension, every nerve twanging to the breaking point like snarled and taut wire. But the left half of his body went slack, soft, and quietly burned-out as four AM in bed beside someone you picked up a little after midnight at a heavy boozing and doping party.

"Okay, now relax and drift on back through the changes," said peppermint and red wine.

Sight became a flickering sequence: blue mists drifting across a field of orange-red, sunshine yellow pulsing through sea green in a tidal rhythm, four people seated in a circle around Harry Krell on a sunlit porch. Back and forth, in and out, the visions chased each other through every possible variation of the sequence, while Marvin heard the pounding of the surf, the symphony for four souls; tasted minty-cool, chowder-hot, smoked chili peppers, flat highballs, peppermint and red wine. The sensual images crossed and recrossed, blending, clashing, melding, bouncing off each other, until concepts like taste, sight, hearing, smell, feel, became totally meaningless.

Finally (time had no referents in this state) Marvin's sensorium stabilized. He saw Tish Connally, Mike Warren, Marty Klein and himself seated on cushions in a circle around Harry Krell on a sunlit wooden porch. He heard the crashing of the surf on the rocks below, felt the softness of the cushion on which he sat, smelled a mixture of sea breeze and his own sweat.

Krell was bathed in sweat, looked drained, but managed to smile smugly

in his direction. The others appeared not quite as dazed as Marvin felt. His mind was completely empty in that moment, whited-out, overwhelmed, nothing more than the brain center where his sensory input merged to form his sensorium, that constellation of sight, smell, sound, taste, touch, and feel which is the essential and basic ground of human consciousness.

"I hope you weren't disappointed, Mr. Marvin," Krell said. "Or would you like your money back?"

Bill Marvin had nothing to say; he felt that he hardly had enough self-consciousness to perceive words as more than abstract sequences of sound.

The bright afternoon sun turned the surface of the pool into a rippling sheet of glare which seemed to dissolve into glass chiming and smashing for a moment as Marvin stared at the incandescent waters. Even his normal senses seemed unusually acute—he could clearly smell the sea and the stables, even here at poolside, feel the grainy texture of the plastic cloth of the beachchair against his bare back—perhaps because he could no longer take any sensory dimension for granted, with the synesthetic flashes he was getting every few minutes. There was no getting around the fact that what he had experienced that morning had been a profound experience, and one that still sent echoes rippling through his brain.

Karen pulled herself out of the pool with a shake and a shudder that flashed droplets in the sun, threw a towel around herself and plopped down in the beachchair next to his. She was wearing a minimal blue bikini, but Marvin found himself noticing the full curves of her body only as abstract design, glistening arcs of water-sheened skin.

"I can see you've really had a moving session," she said.

"Huh?"

He saw that her eyes were looking straight at him, but in a glazed, unfocused manner. "I'm flashing right now," she said. "I hear you as a low hum, without the usual grinding noises in the way you sit, and . . ."

She ran her hand along his chest. "Cool green and blue, no hard silvers and grays. . . ." She sighed, removed her hand, refocused her eyes. "It's gone now," she said. "All I get unless Harry is really projecting is little bits and pieces I can't hold onto. . . . But someday. . . ."

"Someday you'll be able to stay high all the time, or so Krell claims."

"You know Harry's no fraud now."

Marvin winced inwardly at the word

fraud, thinking what it could be like testifying against Krell. Lord, he might drop me into a synesthetic trance in the middle of the courtroom! But . . . but I could fake my way through if I was really ready for it, if I have enough experience functioning in that state. Krell seems to be able to function, and he's like that all the time. . . .

"What's the matter, Bill?"

"Does my body sound funny or something?" he snapped.

"No, you just had a plain, old-fashioned frightened look on your face for a minute there."

"I was just thinking what it would be like if Krell really could condition you to be like him all the time," Marvin said. "Walking around in a fog like that, sure I can see how it might make things interesting, but how could you function, even keep from walking into trees. . . .?"

"Harry is like that all the time, and he's functioning. You don't exactly see him starving in the street."

"I'll bet you don't see him in the street, period," Marvin said. "I'll bet Krell never leaves this place. The way you see him walking around like a zombie, he probably goes on memory half the time, like a blind man in his house." Yeah, he thought, people, food, money, he makes it all come to him. He probably couldn't drive a mile on the freeway or even walk across a street without getting killed. Suddenly Marvin found himself considering Harry Krell's inner reality, the strange parameters of his life, with a certain sympathy. What would it really be like to be Krell? To be wide open to all that fantastic experience, but unable to function in the real world except by somehow making it come to you?

Making it come to you through a greasy con-game, he told himself angrily, annoyed at the softness towards Krell that had sneaked into his consciousness, at the momentary blunting of the keen edge of his determination.

Rising, he said: "I'm going to take a dip and wash some of these cobwebs out of my head."

He took four running steps and dove off the concrete lip of the pool.

When he hit the water, the world exploded for a moment in a dazzling auroral rainbow of light.

How long have you been here?"

"Six weeks," said Tish Connally, lighting a cigarette with a match that momentarily split the darkness of her cabin with a ringing gong in Bill Marvin's head. Another synesthetic flash! He had been at Golden Groves

for only three days now, and the last session with Krell had been at least five hours ago, yet he was still getting two or three flashes an hour.

He leaned back against the headboard of the bed, felt Tish's body exhale against him, saw the glow of her cigarette flare brightly, then subside. "How long do you think you'll stay?" he asked.

"Till I have to go make some more money somehow," she said. "This isn't the cheapest joint I've ever seen."

"Not until you graduate, become another Harry Krell?"

She laughed; he could feel her loose flesh ripple, almost see pink gelatin shaking in the dark. A flash—or just overactive imagination?

"That's a con," she said. "Take it from an expert. For one thing, there are people who have been in and out of here for months, and they still need their boosters from Harry to keep flashing. For another, Krell wouldn't turn you on permanently if he could. We wouldn't need him any more then; where would his money come from?"

"Knowing that, you still stick around?"

"Billy-boy, I've kicked around for ten years, I've been taken every way there is to be taken, took men every way there was for me to take 'em. Before I came here, I'd felt everything there was to feel fifty thousand times, so no matter what I did to get off, I was just going through the motions. At least here I feel alive in bits and pieces. So I'm paying Krell a pretty penny for getting me off once in a while. I've made most of my money on the other end of the same game, so what the hell, it keeps the money in circulation, right?"

"You're a mean old broad," Marvin said, with a certain affection.

She snubbed out her cigarette, kissed him lightly on the lips, rolled toward him.

"One more for the road, Billy-boy?"

Diffidently, he took her tired flesh in his arms. "Oh, you're golden!" she sighed as she moved against him. And he realized that she had been hoping for a synesthetic flash to give her a bit of the sharp pleasure that he alone could not.

But he could hardly feel anger or disgust, since he had been looking for something more spectacular than a soft human body in the darkness, too.

Strolling towards his cabin near the sea-cliffs in the full moonlight, Bill Marvin saw Harry Krell emerge from Lisa Scott's cabin and walk down the



***"Marvin heard the
pounding of the surf,
tasted minty-cool,
chowder-hot,
smoked chili peppers,
flat highballs,
peppermint and red
wine.***

path towards him, more rapidly and surely than he usually seemed to move in broad daylight. They met in a small grove of trees, where the moonlight filtered through the branches in tiger-strips of silver and black that shattered visual images into jigsaw patterns.

"Hello, Marvin," Krell said. "Been doing some visiting?"

"Just walking," Marvin said neutrally, surprising himself with his own desire to have a civil conversation with Krell. But after all, strictly as a curiosity, Krell had to be one of the most interesting men on earth.

Krell must have sensed something of this, because he stopped, leaned up against a tree, and said: "You've been here a week now, Marvin. Tell me the truth, do you still hate my guts? Are you still out to get me?"

Gladd to have his reaction masked by the camouflage-pattern of moonlight and darkness, Marvin caught his breath, said: "What makes you think I'm out to get you?"

Krell laughed, and for a moment, Marvin saw a bright blue cataract smashing off a sheet of glass in brilliant sunlight. "I heard the look on your face," Krell said. "Besides, what makes you think you're the first person that's come here trying to nail me?"

"So why'd you let me come here?"

"Because half the Golden Groves regulars come here the first time to get the goods on that phony Harry Krell. If I worried about that, I'd lose half my trade."

"I just can't figure where your head's at, Krell. What do you think you're doing here?"

"What am I doing?" Krell said, an edge of whining bitterness coming into his voice. "What do you think I'm doing? I'm surviving as best I can, same as you. You think I asked for this? Sure, a lot of nuts come through here and convince themselves they're getting religious visions off of me, a big ecstasy trip. Great for them! But for Harry Krell, synesthesia's no ecstasy trip, let me tell you! I can't drive a car or walk across a street or go anywhere or do anything. All I can do is hear the pretty colors, smell the music, see the taste of whatever crap I'm eating. After three years, I got enough experience to guess pretty well what's happening around me most of the time as long as I stay on familiar ground, but I'm just guessing, man! I'm trapped inside my own head. Like now, I see something blue-green off to the left—probably the sea I'm smelling—and pink-violet stuff around us—trees, probably eucalyptus. And I hear some kind of gong. There's a moon out, right? If you're saying something now, I can't make it out until I start hearing sound again. Man, I'm so alone here inside this light-show!"

Bill Marvin fought against his own feelings, and lost. He couldn't stop himself from feeling sympathy for Harry Krell, locked inside his weird private reality, an ordinary slob cut off from any ordinary life. Yet Krell was entirely willing to put other people into the same place.

"Feeling like that, you still don't mind making your bread by sucking other people in with you. . . ." he said.

"Jesus, Marvin, you're a pornographer! You give people a kick they want, and you make your living off of it. But does it turn you on? How'd you like your whole life to be a pornographic movie?"

Bill Marvin choked on a wisecrack which never came out. Because the deadening quality of what his life had be-

come slammed him in the gut. What is the difference between me and Krell? he thought. He gives the suckers synesthetic flashes and I give 'em porn. What he's putting out doesn't turn him on any more than what I put out turns me on. We're both alone inside our heads and faking it. He got hit on the head by a surfboard and got stuck in the synesthesia trip, and I got hit on the head by Hollywood and got stuck in the porn trip.

"Sorry to put you on such a bumner, Marvin," Krell said. "I can smell it on you. Now I can hear your face. What...?"

"We're both alike, Krell," Marvin said. "And we both stink."

"We're just doing what we gotta do. You gotta play the cards you've been dealt, because you're not going to get any others."

"Sometimes you deal yourself your own lousy hand," Marvin said.

"I'll show you lousy!" said Krell. "I'll show you how lousy it can be to walk just from here to your cabin—the way I have to do it. You got the guts?"

"That's what I'm paying my money for," Marvin said quietly. He began walking back up the path. Krell turned and walked beside him.

Abruptly, the darkness dissolved into a glowing gingerbread fairland of light. To Marvin's left, where he knew the sea was crashing against the base of the cliffs, he saw a bright green-yellow bank of brilliance that sent out pulses of radiance which struck invisible objects all around him, haloing them in all the subtle shades

***"All I can do is hear the
pretty colors, smell
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trapped inside my head,
and I'm just guessing what is
happening around me."***

of the spectrum, forming an infinitely-complex lattice-work of ever-changing, intersecting wavefronts that transformed itself with every pulse from the aural sun that was the sea. Beside him, Harry Krell was a shape of darkness outlined in a shimmering aurora. He heard a far-away gong chiming pleasantly in the velvet quiet. He tasted salt and smelled a rapidly-changing sequence of floral odors that might have been Krell speaking. The beauty of it all drenched his soul through

every pore.

He talked slowly along, orienting himself by the supposition that the green-yellow brilliance was the breaking surf, that the areas of darkness outlined by the living lacework of colored wavefronts were solid objects to be avoided. It wasn't easy, but it was somehow enchanting, picking his way through a familiar scene that had transformed itself into a universe of wonder.

Then the world changed again. He could hear the crashing of the sea. On his left, he saw a thick blue-green spongy mass, huge and towering; on the ground, the path was a ribbon of blackness through a field of pinkish-gray; here and there fountains grew out of the pinkish-gray, with grayish stems and vivid maroon crests, tree-high. He smelled clear coldness. Krell was a doughy mass of colors, dominantly washed-out brown. Marvin guessed that he was seeing smell.

It was easy enough to follow the path of dead earth through the fragrant grass. After a while there was another, subtler transformation. He could see that he and Krell were walking up the path towards his cabin, no more than twenty yards away in the silvery moonlight. But his mouth was filled with a now-winey, now-nutty flavor that ebbed and flowed with an oceanic rhythm, here and there broken by quick wisps of spiciness as bird-shapes flapped from tree to darkened tree. The only sound was a soft, almost subliminal hiss.

Dazed, transported, Marvin covered the last few yards to his cabin open-mouthed and wide-eyed. When they reached the door, the strange tastes in his mouth evaporated, and he could hear the muffled grumble of the pounding surf. He laughed, exhilarated, refreshed in every atom of his being, alive to every subtle sensory nuance of the night.

"How do you like living where I live?" Krell said sourly.

"It's beautiful . . . it's . . ."

Krell scowled, snickered, smiled ruefully. "So the big wise-guy turns out to be a sucker just like everyone else," he said, almost regretfully.

Marvin laughed again. In fact, he realized, he had been laughing for the first time in over a week. "Who knows, Krell," he said, "you might enjoy living in one of my pornographic movies."

He laughed one more time, then went into his cabin, leaving Krell standing there in the night with a dumb expression on his face.

Later, when he got into bed, the cool sheets and the soft pillow were a clear night full of pinpoint-bright multicol-

ored stars, and the darkness smelled like a woman's perfume.

The world went livid red, and the wooden slats beneath his naked body became a smoky tang in his mouth. Marvin felt himself glowing in the center of his being like a roaring winter fireplace, heard Dave Andrews' voice say: "Really sweats the tension out of you."

The flash passed, and he was lying on the wooden bench of the sauna shack, bathed in his own luxuriant sweat, baking in the heat given off by the hot stones on their cast iron rack. The fat, wet-wrapped man on the bench across from him stared sightlessly at the ceiling and sighed.

"Phew!" Andrews said as his eyes came back into focus. "I could really hear my muscles uncoil. Twooong!"

Marvin lay there just sucking up the heat, going with it, and entirely ignoring Andrews, who was some kind of land speculator, and a crashing bore. He closed his eyes and concentrated on the waves of heat which he could-all-but-feel breaking against his body, the relief of the grain of the wood against his skin, the subtle odor of hot stone. He had learned to bask in the world of his senses and let everything else drift by.

"I tell you, old Krell may be charging a pretty penny, but it sure cleans out the old tubes and charges up the old batteries. . . ." Andrews babbled on and on like a radio commercial, but Marvin found little trouble in pushing the idiot voice far into the sensory background; it was easy, when each sense could become a universe entire, when your sensorium was more fully conditioned to sight-sound dominance.

Suddenly Andrews' voice was gone, and Marvin heard a whistling hurricane wind. Opening his eyes, he saw wispy white billows of ethereal steam punctuated by the multicolored static of Andrews' words. He tasted something like curry and smelled a piny, convoluted odor.

When the flash passed, he got up, slipped on a bathing suit, dashed out of the sauna, ran across the rich green grass in the high blue sunlight, and dove straight into the swimming pool. The cool water hit his superheated body with an orgasmic shock. He floated to the surface and let the little wavelets cradle him on his back as he paddled over to the lip of the pool, where Karen sat dangling her feet in the water.

"You're sure a different man than when you came here," she said.

Looking up, Marvin saw her bikini

form as a fuzzy vagueness against a blinding blue sky. "Well, okay, so Krell's got something going for him," he said. "But at these prices, he's still a crook, and the funny thing is, he thinks he's even a bigger crook than he really is. . . ."

She didn't answer for a long moment, but stared into the depths of the pool to one side of him, lost in the universe of her own synesthetic flash.

When she finally spoke, it came out as a gusher of glistening green-black oil emerging from soft lavender clouds, while Marvin tasted icy cotton-candy. Judging from the discord of her face jarring the soothing melody of the sunlit sky, it was probably just as well.

"Waves of nostalgia and disgust formed inside him, crested, broke, and merged in a single emotional tone for which there was no word. It was simply the space Karen occupied in his mind."

Marvin luxuriated in a shower of blood-warm rain, saw a sheen of light that pulsed from sunshine yellow to sea green; then the flash passed. He was sitting on his cushion on Harry Krell's sunny porch, in a circle around Krell, along with Tish, Andrews . . . and Karen.

Strange, he thought, I've been here nearly three weeks, and I haven't had a booster group with Karen yet. Stranger still was the realization that this hadn't seemed peculiar or even significant until this moment. Like the rest of the outside world, his former relationship with Karen seemed so long ago and far away. The woman to his right seemed no closer to him emotionally than any of the other residents of Golden Groves, who drifted through each other's private universes like phantom ships passing in the night.

Harry Krell took a deep breath, and the vault of the sky became a sheet of gleaming brass; below, the sea was a rolling cauldron of ebony. The porch itself was outlined in dull blue, and the people around him were throbbing shapes of yellowish pink. To his left, the odor of fading incense; across the way, rich Havana smoke, and the powerful tinge of ozone pervaded all. But the smell that riveted

Marvin's attention was the one on the right: an overwhelming feminine musk that seemed compounded of (or partially masked by) unsuitable perfume, drying nailpolish, beauty cream, shampoo, deodorants, the full spectrum of chemical enhancers which he now realized had been the characteristic odors of living with Karen. Waves of nostalgia and disgust formed inside him, crested, broke, and merged in a single emotional tone for which there was no word. It simply was the space that Karen occupied in his mind, the total image through which he experienced her.

Another change, and he saw light pulsing from yellow to green once more, tasted a salty tang. From his left, he heard the ricky-tick of a funky old piano; across the way, a straccato metallic blating; over it all, the brassy, hollow, melancholy wailing of Harry Krell. But once again, it was the theme on his right that vibrated a nerve that went straight from his senses through his brain and into the pit of his gut. It was as if a gong were striking within an enclosure that rudely dampened its vibrations, slamming the echoing notes back on each other, abruptly amputating the long, slow vibrations, creating a sound that was a hysterical hammering at invisible walls, the sound of an animal caught in some invisible trap. Ironically, the smell of a woodland field in high summer was heavy in Marvin's nostrils.

After a few more slow changes, Krell brought them flickering back through the sequences: blood-warm rain, a sheet of gleaming brass over an ebon sea, the smell of feminine musk and body chemicals, light pulsing from yellow to green, rich Havana smoke, peppermint and red wine, high summer in a woodland field, flat highballs, melancholy wailing, ricky-tick. . . .

Then Marvin was seated on his cushion next to Karen's, while the sea tumbled to itself below, and Harry Krell breathed heavily and wiped sweat out of his eyes.

Marvin and Karen simultaneously turned to look at each other. Their eyes met, or at least their focal planes intersected. For Marvin, it was like staring straight at two cold green marbles set in the alabaster face of a statue, for all the emotion that the eye-contact contained. Judging from the ghost of a grimace that quivered across her lips, she was seeing no less of a stranger. For an instant, he was blinded by yellow light, sickened by the odor of her chemical musk.

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LOOK, YOU THINK YOU'VE GOT TROUBLES?

from page 67

ercise, labor, hospitals, formulas and sleep-taught toilet training. When I'm starting to feel that I'm getting over-educated, I decide to go into the kitchen and make myself a bite to eat. I could have asked them for a little something but I don't want to interfere with their first conversation. Sadie has all engines going and is interrupting four times a sentence, which is exactly the kind of game they always had back home—my daughter's goal is to say one complete thought out loud. If Sadie doesn't spring back with a non sequitur, Lorinda wins that round. A full-fledged knock-out with Sadie still champion is when my daughter can't get a sentence in for a week. Sometimes I can understand why she went to Mars.

Anyway, while they're at the height of their simultaneous monologues, I go quietly off to the kitchen to see what I can dig up. (Ripe parts of Mor, wrapped in plastic? Does he really regenerate, I wonder. Does Lorinda fully understand how he works or one day will she make an asparagus omelet out of one of his appendages, only to learn that's the part that doesn't grow back? "Oh, I'm so sorry," she says. "Can you ever forgive me?")

The refrigerator, though obsolete on Earth, is well stocked—fruits of a sort, steaks, it seems, small chicken-type things that might be stunted pigeons. There's a bowl of a brownish, creamy mess—I can't even bring myself to smell it. Who's hungry, anyway, I think. The rumbling in my stomach is the symptom of a father's love turning sour.

I wander into the bedroom. There's a large portrait of Mor hanging on the wall—or maybe his ancestor. It is true that instead of hearts, Martians have a large avocado pit? There's a rumor on Earth that when Martians get old they start to turn brown at the edges, like lettuce.

There's an object on the floor and I bend down and pick it up. A piece of material—at home I would have thought it was a man's handkerchief. Maybe it is a handkerchief. Maybe they have colds like us. They catch a germ, the sap rises to combat the infection, and they have to blow their stamens. I open up a drawer to put the piece of material in (I like to be neat), but when I close it, something gets stuck. Another thing I can't recognize. It's small, round and either concave or convex, depending on how you look at it. It's made of something black and shiny. A cloth bowl? What would a vegetable be doing with a cloth bowl? Some questions are too deep for

me, but what I don't know I eventually find out—and not by asking, either.

I go back to the living room.

"Did you find anything to eat?" Lorinda asks. "Or would you like me to fix—"

"Don't even get up," Sadie says quickly. "I can find my way around any kitchen, I don't care whose."

"I'm not hungry. It was a terrible trip. I thought I'd never wake up from it in one piece. But the way, I heard a good riddle on the ship. What's round and black, either concave or convex, depending on how you look at it, and made out of a shiny material?"

Lorinda blushed. "A skullcap? But that's not funny."

"So who needs funny? Riddles have to be a laugh a minute all of a sudden? You think Oedipus giggled all the way home from seeing the Sphinx?"

"Look, Daddy, I think there's something I should tell you."

"I think there are all sorts of things you should tell me."

"No, I mean about Mor."

"Who do you think I mean, the grocery boy? You elope with a cucumber from outer space and you want I should be satisfied because he's human in all the important ways? What's important—that he sneezes and hiccups? If you tell me he snores, I should be ecstatic? Maybe he sneezes when he's happy and hiccups when he's making love and snores because it helps him think better. Does that make him human?"

"Daddy, please."

"Okay, not another word." Actually I'm starting to feel quite guilty. What if she has a miscarriage right on the spot? A man like me doesn't blithely torture a pregnant woman, even if she does happen to be his daughter. "What's so important it can't wait till later?"

"Nothing, I guess. Would you like some chopped liver? I just made some fresh."

"What?"

"Chopped liver—you know, chopped liver."

Oh yes, the ugly mess in the refrigerator. "You made it, that stuff in the bowl?"

"Sure. Daddy, there's something I really have to tell you."

She never does get to tell me, though, because her husband walks in, bold as brass.

I won't even begin to tell you what he looks like. Let me just say he's a good dream cooked up by Mary Shelley. I won't go into it, but if it gives you a small idea, I'll say that his head is shaped

like an acorn on top of a stalk of broccoli. Enormous blue eyes, green skin and no hair at all except for a small blue round area on top of his head. His ears are adorable. Remember Dumbo the Elephant? Only a little smaller—I never exaggerate, even for effect. And he looks boneless, like a flet.

My wife, God bless her, I don't have to worry about; she's a gem in a crisis. One look at her son-in-law and she faints dead away. If I didn't know her better, if I wasn't absolutely certain that her simple mind contained no guile, I would have sworn she did it on purpose, to give everybody something to fuss about. Before we know what's happening, we're all in a tight, frantic conversation about what's the best way to bring her around. But while my daughter and her husband are in the bathroom looking for some deadly chemical, Sadie opens both eyes at once and stares up at me from the floor.

"What did I miss?"

"You didn't miss anything—you were only unconscious for fifteen seconds. It was a cat nap, not a coma."

"Say hello, Hector. Say hello to him or so help me I'll close my eyes for good."

"I'm very glad to meet you, Mr. Trumbnick," he says. I'm grateful that he's sparing me the humiliation of making the first gesture, but I pretend I don't see the stalk he's holding out.

"Smutual," I say.

"I beg your pardon?"

"Smutual. How are you? You look better than your pictures." He does, too. Even though his skin is green, it looks like the real thing up close. But his top lip sort of vibrates when he talks, and I can hardly bear to look at him except sideways.

"I hear you had some business this afternoon. My daughter never did tell me what your line is, uh, Morton."

"Daddy, his name is Mor. Why don't you call him Mor?"

"Because I prefer Morton. When we know each other better I'll call him something less formal. Don't rush me, Lorinda; I'm still getting adjusted to the chopped liver."

My son-in-law chuckles and his top lip really goes crazy. "Oh, were you surprised? Imported meats aren't a rarity here, you know. Just the other day one of my clients was telling me about an all-Earth meal he had at home."

"Your client?" Sadie asks. "You wouldn't happen to be a lawyer?" (My wife amazes me with her instant familiarity. She could live with a tyranno-

saurus in perfect harmony. First she faints, and while she's out cold everything in her head that was strange becomes ordinary and she wakes up a new woman.)

"No, Mrs. Trumbnick. I'm a—"

"—rabbi, of course," she finishes. "I knew it. The minute Hector found that skullcap I knew it. Him and his riddles. A skullcap is a skullcap and nobody not Jewish would dare wear one—not even a Martian." She bites her lip but recovers like a pro. "I'll bet you were out on a Bar Mitzvah—right?"

"No, as a matter of fact—"

"—a Bris. I knew it."

She's rubbing her hands together and beaming at him. "A Bris, how nice. But why didn't you tell us, Lorinda? Why would you keep such a thing a secret?"

Lorinda comes over to me and kisses me on the cheek, and I wish she wouldn't because I'm feeling myself go soft and I don't want to show it.

"Mor isn't just a rabbi, Daddy. He converted because of me and then found there was a demand among the colonists. But he's never given up his own beliefs, and part of his job is to minister to the Kopchopees who camp outside the village. That's where he was earlier, conducting a Kopchopee menopausal rite."

"A what!"

"Look, to each his own," says my wife with the open mind. But me, I want facts, and this is getting more bizarre by the minute.

"Kopchopee. He's a Kopchopee priest to his own race and a rabbi to ours, and that's how he makes his living? You don't feel there's a contradiction between the two, Morton?"

"That's right. They both pray to a strong silent god, in different ways of course. The way my race worships, for instance—"

"Listen, it takes all kinds," says Sadie.

"And the baby, whatever it turns out to be—will it be a Choptapi or a Jew?"

"Jew, shmoo," Sadie says with a wave of dismissal. "All of a sudden it's Hector the Pious—such a megilla out of a molehill." She turns away from me and addresses herself to the others, like I've just become invisible. "He hasn't seen the inside of a synagogue since we got married—what a rain that night—and now he can't take his shoes off in a house until he knows its race, color and creed." With a face full of fury, she brings me back into her sight. "Nudnick, what's got into you?"

I stand up straight to preserve my dignity. "If you'll excuse me, my things are getting wrinkled in the suitcase."

Sitting on my bed (with my shoes on), I must admit I'm feeling a little different. Not that Sadie made me change my mind. Far from it; for many years now her voice is the white sound that lets me think my own thoughts. But what I'm realizing more and more is that in a situation like this a girl needs her father, and what kind of a man is it who can't sacrifice his personal feelings for his only daughter? When she was going out with Herbie the Hemopheliac and came home crying it had to end because she was afraid to touch him, he might bleed, didn't I say pack your things, we're going to Grossingers Venus for three weeks? When my twin brother Max went into kitchen sinks, who was it that helped him out at only four per cent? Always, I stood ready to help my family. And if Lorinda ever needed me, it's now when she's pregnant by some religious maniac. Okay—he makes me retch, so I'll talk to him with a tissue over my mouth. After all, in a world that's getting smaller all the time, it's people like me who have to be bigger to make up for it, no?

I go back to the living room and extend my hand to my son-in-law the cauliflowerer. (Feh.) O



"I notice my daughter is having a little trouble looking me straight in the face, which is only as it should be."

kilometers) above sea level. Except for the polar regions, it will pass over every spot on Earth once every five days as it gathers data about (a) the sun, (b) the surface of Earth and (c) the physiological condition of its crew.

The real "mission" for Skylab, however, seems to be a last ditch attempt to prove to a somewhat hostile public that space exploration is worth the investment, to justify an enormous budget to an administration which is publicly committed to slashing government expenditures, and to convince the taxpayers that Skylab isn't just one more television spectacular designed to bring them those clever Gulf Oil and North American Rockwell commercials. In short, Skylab is an attempt to prove to the man in the street that putting men in space is a "practical" venture while at the same time trying to mollify a scientific community which is fed up to the teeth with heroics on the moon. Thus, National Aeronautics and Space Administration head James C. Fletcher's statement to newsmen last year:

"Skylab is aimed almost entirely at producing more practical information about the Earth. The Earth Resources Experiments Package, for example, will take detailed pictures, including infrared, which will give us a completely new understanding of the Earth's surface. We'll get a good idea of day-to-day conditions affecting mineral and ocean resources, agricultural changes, water resources, and forestry."

Six cameras will simultaneously photograph the same area, each seeing a different wavelength. The advantage of multispectral photography, according to NASA, is that various conditions such as soil moisture, types of vegetation or health of the vegetation produce different spectral responses or signatures. For use when cloud cover foils optical snooping, Skylab carries a Multispectral Scanner of the sort already proven in high altitude crop identification, and a Microwave Radiometer/Scatterometer/Altimeter experiment.

"In addition to that," the NASA head continued, "there will be a lot of biological experiments, primarily medical, to see what the effects of long-duration activity are on men. There will be three men on each visit: the first team for 28 days, the second and third for 56 days each."

Essentially, Skylab is a converted Saturn V third stage, 48.1 feet tall by 21.6 feet in diameter, its huge liquid hydrogen tank modified into a 10,000

cubic foot workshop. Crew quarters are at the aft end of the tank (on the bottom as it sits on the launch pad), and are divided by solid partitions into sleep compartments, a wardroom, a "waste management compartment," and a work/experiment space. Above the aluminum grid ceiling of the crew quarters is the main workshop area, containing most of the paraphernalia for the approximately 60 scheduled experiments.

Stacked "on top" of the workshop are three other elements—the Apollo Telescope Mount, Airlock Module and Multiple Docking Adaptor. These four components form the Skylab cluster, which will be launched April 30, 1973. A day later the Command Service Module, containing the three-man crew, will rendezvous with the cluster and insert its nose into the MDA, where it will remain parked awaiting the crew's return to Earth 28 days later.

The crew for Mission One will be headed by Navy Captain Charles "Pete" Conrad, Jr., a veteran of the Gemini and Apollo programs. Conrad has already logged 506 hours and 49 minutes in space during his three previous flights, one of which included a walk on the moon, making him something of an old hand at the business of being a spaceman. Frequent television appearances promoting Skylab have made him something of a celebrity, too.

Two other Navy men, Commanders Joseph P. Kerwin and Paul J. Weitz, will accompany Conrad on the mission. Kerwin is an M.D. and will function as flight surgeon in charge of the biomedical experiments; Weitz will pilot the Apollo command module which takes the crew to and from their tour of duty in Skylab.

Pete Conrad is an adventurer, almost in the classic tradition, rather than a scientist, and as an adventurer he qualifies more than the others for the old-time space opera designation, *spaceman*. Another man might be given to philosophical reflections upon the grandeur of the universe, or be awed by the three-billion-year age of the moonrock in his spacesuited hand, but not Conrad. "You don't have much time on a mission for philosophical reflection," claims Conrad, whose accomplishments include not only being the third man on the moon, but the first person to play golf on the moon. He is described by fellow astronaut Frank Borman as a "high-metabolism, high-energy" individual. Making it all look easy, Conrad made numerous television appearances during the flight of

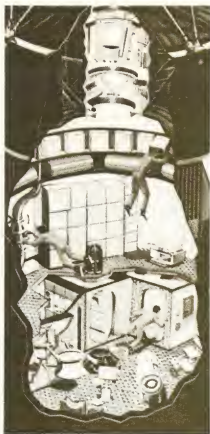
Apollo 17 in December while maintaining a full training schedule for the Skylab mission, about which he impatiently observes, "Twenty-eight days is not long enough."

Clearly, Conrad is eager to get at it. "We have three major objectives: the first one is to prove that man can live up there and do useful work during long-duration space flight, that's number one. Number two, we have a solar telescope, which consists of about six instruments that we're going to observe the sun with; four of these instruments have to use space to operate, they cannot get their data looking through our atmosphere. We will bring back, probably, information about the sun that cannot be gotten in any other manner, the same as the only way we were to find out about the moon was to go to the moon. The third thing we have is a set of Earth Resource packages on board. I guess, to coin a phrase, to turn inward in the space program and look at some of our problems, we're going to use these to observe the Earth. Man is required in the loop for some of these, and we feel, along with the manned and the unmanned portion of the program, that all this knowledge that we'll gain from it will help most everybody on the world."

The theme of usefulness and applicability dominates Skylab's press releases, and recurs throughout the aerospace industry, which has undergone near-traumatic economic difficulties stemming from cutbacks in space program funding by the Nixon administration. Space as man's legitimate domain is ably defended by Dr. Kraft Ericke, who contends, "There is no more down-to-earth business than space business, because space business ultimately guarantees that we will be able to continue to exist and live on this planet without destroying this planet."

The experiments to be conducted during Skylab missions range from solar astronomy and stellar/galactic astronomy through Earth resources measurements, external contamination measurements (will Skylab's water and urine dumps, for instance, pollute the optics of the astronomy studies?), materials technology and science, in addition to the habitability, medical and bioscience studies previously mentioned.

Atmosphere-free optics is the enabling condition for the astronomy experiments involving the Apollo Telescope Mount, permitting measurements of the sun in the extreme ultraviolet and X-ray portions of the electromagnetic spectrum (which does not penetrate Earth's at-



According to NASA, Skylab is aimed almost entirely at producing more practical information about the Earth.

teristics. Gravity is what causes hot air to rise; without gravity, there are no convection currents to bring new oxygen into contact with the flame. Previous zero-G flame propagation studies have been conducted in aircraft. Self-extinguishment occurred but the flame reappeared when convection resumed at the end of weightlessness. Skylab will provide longer test times and correspondingly more information.

Probably the most unusual and refreshingly trivial experiment will involve a common cross spider, in an attempt to determine the importance of gravity in the spider's web-building process. Judith S. Miles, a Lexington, Mass., high school student, suggested the experiment and designed the special equipment required for it. The orbiting (and therefore weightless) spider's web will be compared with webs constructed by Earth-bound spiders of the same species (*areneus diadematus*).

One of the most science-fictiony problems to be investigated is that of personal jet-packs for EVA maneuvering. Almost 40 years ago Buck Rogers (as portrayed on film by Buster Crabbe) wore miniature rockets on his back; in George Pal's 1951 sf movie, *Destination Moon*, EVAing crewmembers rode oxygen bottles. NASA combined the two ideas, changed the oxygen to nitrogen, and produced two jet-powered units: a back-mounted hand-controlled unit called the *automatically stabilized maneuvering unit* (ASMU, or backpack) and a hand-held maneuvering unit (HHMU), both using the same rechargeable/replaceable high pressure nitrogen propellant tank, reminiscent of an overgrown CO₂ cartridge.

Both the ASMU and HHMU require the astronaut to use his hands to control the unit. To overcome this limitation, Donald E. Hewes of Langley Research Center has invented a foot controlled maneuvering unit (FCMU), which the astronaut straddles like a bicycle. This, too, uses the same nitrogen tank as ASMU and HHMU.

Maneuvering in a weightless environment is maneuvering without the natural friction braking system which we take so much for granted on Earth that we seldom think of it. In zero gravity, however, there is practically no resistance to a motion once it is begun. As astronaut Tom Stafford explains it: "When you start to turn, if you have no resistance, you will just continue to turn. In fact, on the way back from the moon on Apollo 10, it was so much fun that the three of

us were down in the lower equipment bay and we'd spend three or four minutes just turning round and round—it was a ball."

Dervishes in Turkey and North Africa are said to get quite intoxicated from their high-speed ritual whirling, as do young children on playground equipment. The alteration of consciousness they experience is thought to be produced by spacial disorientation due to interference with the inner ear balance sensing apparatus. The combined effects of spinning and weightlessness will be explored in a series of Human Vestibular Function experiments designed by researchers at the Naval Aerospace Medical Institute at Pensacola, Fla. The special equipment involved includes a motorized rotating chair which tilts in four directions, a test goggle with an adjustable illuminated "horizon" line, and a reference sphere with a magnetic indicator rod by which the astronaut can, without looking, indicate what he considers his body orientation to be.

Weightlessness can be fun, and in a playful organism can inspire playful activity. It can also be physiologically alarming. Former astronaut Wally Schirra cites weightlessness as the most frightening aspect of his trips into space. "The body suffered" he said in a recent interview. "The weightlessness was like not needing a skeleton. Also the muscles atrophy—they decay and there is a loss of weight in the muscles. In 10 or 12 days our weight diminished tremendously. We have to develop techniques to bolster the body in space." Schirra spent 260 weightless hours in orbit in October 1968 as commander of Apollo 7. Bone mineral losses and muscle tissue shrinkage experienced during Gemini and Apollo flights prompted Skylab researchers to devote almost one-third of their experiments to detailed in-flight measurements of the astronauts themselves.

"If you just stay up there with nothing to do," the energetic Pete Conrad observes, "you tend to wind up like you're a bed-rest patient. We have devices on board where we will be able to exercise, though." Periodic monitoring of the crew's body functions will keep track of physiological changes and hopefully point to their causes. Detailed "think of everything" procedures have been set up to accomplish this task.

A case in point is the Mineral Balance experiment (M071) which NASA describes this way:

"The objective of this experiment is to determine if the absence of gravity on the muscle and skeletal systems of the body
[turn to page 88]

mosphere), and also to observe the sun's corona in the white light portion of the spectrum.

Ultraviolet line spectra will be obtained from a large number of stars, including clouds and stars in the Milky Way, to provide insight into the origin and composition of the stars, nebulae, and interstellar dust. Proportional counters will survey the sky for faint X-ray sources. The ultraviolet brightness of more than 1,000 stars at various locations in our galaxy will be measured, as a basis for future studies of the spiral arms of the galaxy.

Weightlessness is the key condition involved in most of the material science and manufacturing experiments. For example, the behavior of molten metals in micro-gravity will be studied, along with the structures formed in metals melted and solidified rapidly in zero gravity. The Air Force has been interested in hollow ball bearings, impossible to manufacture on Earth—metallurgists theorize they can be made in space. A Skylab experiment is designed to find out. In another, zero gravity casting of aluminum alloy or lamellar eutectic composites will be undertaken with an eye to obtaining a more perfect structure.

Still another experiment will provide photographs of assorted combustible materials ignited under controlled conditions in the zero-G environment in order to find their flame propagation, flashover and extinguishment charac-

THE ART OF TIM KIRK



There's a semi-secret sub-culture called science fiction fandom. It's not just people in general who like science fiction and fantasy, but those who are active within it, publishing amateur magazines, writing, drawing, holding regional and even world conventions. It started back in the early Thirties and many of the Big Names you read today, from Bradbury to Silverberg, from Ellison to Terry Carr, started as "fans."

Within that delightful little sub-world a number of truly talented "fan artists" have emerged, and some have achieved professional status: George Barr and Alicia Austin, to name two, each of whom have won the coveted "Hugo" for best fan artist. But perhaps the best, and the first and only winner of two Hugos (science fiction's Oscar) is a quiet, dark, sardonically smiling 26-year-old lad named Tim Kirk.

His cheerful monsters, his mysteri-

ous castles and alien space ships, his cartoons and Tolkeinesque paintings, have delighted everyone.

Tim has spent all but two years of his life in Long Beach, California, where he is currently finishing off his master's degree project with a series of paintings about Tolkien's *Lord of the Rings*.

Like every other good artist he started drawing at so early an age that he can't ever remember not drawing. Luckily, his parents encouraged him, and today he has produced art for innumerable "fanzines" as well as many professional assignments. "I hope eventually to do wildlife illustration and children's books," he says. Influenced by such artists as N. C. Wyeth, Arthur Rackham, and the Disney Studios, plus such comic artists as Walt Kelly (Pogo), Hal Foster (Prince Valiant), and Carl Barks, who was responsible for *Uncle Scrooge* and most of the wittier Disney comic stories, he is also a fan of Ed Cartier, Sidney Sime, Garth Williams, Edmund Dulac, Gustave Dore, Heinrich Kley, Hannes Bok, Virgil Finlay, and Ernest Shepard, "who did what are, in my opinion, the best illustrations for *Grahame's The Wind In The Willows*."

Tim has done much non-science-fiction work as well, from letterheads and lollipops to amusement park design, but his fans like his whimsical monsters and smartass dragons the best.

Tim takes pleasure in doing the outrageous with his art, blending elements which the science fiction community usually thinks of as forever separate, such as fantasy, science fiction and humor.

article/William Rotsler



Other worlds and other cultures are a Kirk specialty, with fantasy and science fiction blending into a whole.



Tim Kirk has the almost uncanny ability to combine fun and fantasy with science fiction, making it impossible not to laugh at his creatures.





Tim's spaceships have an almost Gothic look.



Petulant People (?). A Kirk specialty.

Although Tim's reading of fantasy and science-fiction goes back to his earliest childhood, his first contact with the odd little subculture of "fandom" was not until 1968. Encouraged by the delighted response of the fans, he published hundreds of drawings in these amateur magazines, which brought him to the attention of DAW Books, the Mirage Press, Ballantine Books and various professional magazines.

He's good. He's funny. He's unique. He's also self-effacing as hell, which is why I'm writing his biography and not him. Since an artist's work should not have to be explained (or he's failed somewhat) go ye now and look at the illustrations. Tim is very, very good indeed, and it doesn't take me to say so. Enjoy. O



Ordinary fantasy isn't really impossible, just improbable.

Tim Kirk's blend of fantasy, science fiction and humor has earned him a unique award—the only fan artist ever to win two Hugo Awards, the science fiction Oscar.

results in the gain or loss of pertinent biochemical constituents. These constituents are water, calcium, phosphorus, magnesium, sodium, potassium, nitrogen, urea, hydroxyproline, creatinine and chloride. Continuous losses of calcium and nitrogen can, for example, result in impairment of skeletal and muscle systems and the formation of kidney stones.

"The experiment will be accomplished in three phases: (1) preflight from 23 days to 2 days before launch, (2) during flight, and (3) for 18 consecutive days beginning immediately after splashdown. The functions to be performed and the controls to be exercised are as follows:

"Body weight (or mass) will be measured once daily immediately after the first urine voiding following the sleep period.

"A standard diet of defined composition will be used, since the composition of the subject's diet must be known and controlled carefully. Before flight each crewman will use this diet to establish his normal (or baseline) data, reflecting his individual metabolic balance.

"Fluid can be taken as desired, but all intake will be recorded. This includes fluid used for food reconstitution.

"All urine, feces, and vomitus, if any, will be collected pre- and post-flight and preserved for analysis. In flight, the amount of daily urine output from each crewman will be determined and a measured sample taken, frozen and stored for return as experiment data. All feces and vomitus passed will be collected and their mass will be measured. The samples will then be dried and stored for return as experiment data.

"Periodic blood samples, before, during and after flight, will be taken and the concentration of selected constituents determined.

"The biomedical samples, together with the men's comments recorded in the log books, will be returned to Earth at the end of each manned mission."

Determining the weight of a man (or anything else) in zero gravity is a tricky problem, for without gravity everything is weightless. Inertia, however, is independent of gravity; special spring-mounted pendulum devices have been developed for Skylab, with the pendulum period electronically timed. NASA has opted for linear springs (which stretch along their length) for both specimen mass measurements and body mass measurements—the latter involving a spring-restrained chair. A leaf-spring device (which flexes rather than stretches) suggested by high school student Vincent W. Converse will also

be taken along, consisting of a simple leaf spring anchored at one end with a container at the other end into which is placed the mass to be measured. In each case, oscillations will be monitored and electronically displayed; the mass will then be computed from the observed period.

Many of these experiments would doubtless be much simpler if the human element could be removed and the men involved could be reduced to engineering models. The human element is particularly evident in the area of food, as revealed in this statement by Dr. C. Malcolm Smith, chief of NASA's food and nutrition branch:

"When nutritionists decided upon the perfect food for life in space, our astronauts wouldn't eat it."

NASA's nutritionists compromised and came up with a tasty space diet of hot dogs covered with tomato sauce, which was apparently good enough for the Apollo missions, but not good enough for Skylab. Conrad and his companions insisted on a more interesting menu—and got it, along with a freezer system.

"We have a very nice menu on the frozen food," Pete Conrad told a television audience. "We have filet mignon, and lobster Neuberg, and ice cream, and all told there's 72 items on the menu, and it will repeat every six days, so we're in pretty good shape when it comes to food."

"It's part of a medical experiment actually, and the food is very carefully controlled, and the chemical constituents of it are very well known and the food is very chemically stable so that it can be stored. We'll have to store this food for approximately a year."

As noted earlier, the Mineral Balance experiment, which involves this totally controlled diet, begins 23 days before launch and continues for 18 days after splashdown—a total span of 69 days for Conrad and his companions, during which time everything that goes in and comes out of their bodies will be carefully measured, weighed, analyzed, packaged, labeled, stored and noted. Gone is the diapered space man of yesterday. A Skylab first is the space toilet.

According to Arthur C. Clarke, the only intentional joke in his and Stanley Kubrick's film, 2001: A Space Odyssey, was the reading of the zero gravity toilet instructions, which were so long and obliquely worded that a passenger needing to know how to work it would be better off wearing a diaper. The zero-gravity toilet, however, is no joke to the

designers of Skylab, or to its crew. Half of Skylab's human environment experiments involve the space toilet in one way or another. Its engineering details would surely intrigue Thomas Crapper, the 19th Century British inventor of the ball-flush watercloset that first bore his name.

The disposal of urine and feces has always been a problem for orbiting astronauts, although it is seldom discussed on television. The first ones went up in diapers. "That's the reason that, when they came in, they went in—remember that little van?" reminisces McDonnell Douglas spokesman Phillip L. Oster. "Well, what happened, they dropped their diaper, washed off and then came out in their jump suits, that's what happened. Because fourteen days in a diaper is serious, you know."

Clearly, something better than a diaper was needed for a trip to the moon. Space engineers soon found a way to package the waste. In zero gravity, Oster points out, things tend to float around unless they're tied down.

"So, the way we do it when we go to the moon, the guy has a glove, it's a plastic glove; it fits on his hand and it has a long bag with a hole here (between the index and middle fingers) and so when this guy over here wants to go he puts it on his rear and he holds it. And he goes and he closes his fingers and seals it and puts on a white glove and wipes him off clean, and that's the way it's done. Some people don't recognize that technology solves a lot of problems. One of the big technology events we had was coming up with a toilet that worked in space. Because, boy, in a non-... when you don't have any gravity, you've got some real serious problems. You've got to get everybody's rear to fit the seat so they can buckle down with a seatbelt."

Clarke and Kubrick's zero gravity toilet included an ultrasonic shower, "Sonoshower," designed to literally shake the dirt off with ultrasonic vibrations. The shower on Skylab eschews sound waves, however, in favor of good old-fashioned water. The shower "stall" consists of a reinforced fabric tube, resembling a very tall hoop skirt or perhaps a Japanese lantern, made from material which lets air through but not water.

PETE CONRAD: "We have a little bottle that we can heat up six pounds of water and dispense it out of sort of a spray gun like a garden hose nozzle, but it comes out at a low enough velocity so that it won't be going too fast and break up. It tends to stick to your body, with surface

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tension, so you can cover yourself with some water and soap up and then wash it off. Now, when you get done, you're gonna have all this water all over you and all over the inside of the shower, so we also have a little vacuum cleaner in there that will suck up the water and it will put it in a bag that we can seal, because that could grow bugs, and can dump it out through a trash airlock into another container in the vehicle that holds that kind of trash. The way the water ration is we get one shower per man per week."

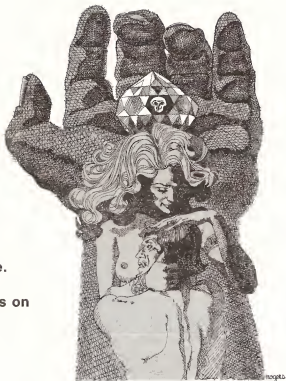
Each crewmember has his own "stateroom," not much bigger than a telephone booth. In null-G, there's no need to lie down to sleep—for that matter, there's no "down"—so the beds are simply white fabric sacks reminiscent of sleeping bags hung on a wall. When sleep time comes around, the astronaut zips himself in and pulls another lightweight bag around his head to keep it from bobbing as he sleeps. "You just hang there, like you're in a cocoon," explains Joe Messick, McDonnell Douglas PR man.

Another Skylab first is the privacy curtain across the entrance to each stateroom. "The astronauts requested that they have a place where they can go where they wouldn't be on camera and could be alone, for whatever the hell it is that they want to do," Oster says. NASA learned the importance of privacy during experiments in a Skylab mockup at McDonnell Douglas's facility in Huntington Beach, California. "We found with those three students we put in that capsule down there for three months," Oster recalls, "once they got inside the capsule they boarded up all the windows, put something over the camera—we don't know what the hell went on."

Skylab. A practical venture, devoted in large part to the task of demonstrating that putting men and machines in space is worth the cost of getting them there. Kraft Ericke, a designer of the shuttle and a pioneer of the space age, puts it this way: "The Earth is wide open to the universe, in which there are riches of energy, light, and raw materials, and in which our machines often can work better. We have the technology, we have the energy, we have the means to establish the industrialization of space, and therefore put the machines where they work better, and give the Earth back to life and to man."

Or, in Pete Conrad's words: All this knowledge that we'll gain from it will help most everybody on the world." ○

"Call it life insurance. I have the feeling that if I had my hands on that rock, my policy might run out."



He'd be stealing it from you at that price."

"It's worse than theft. But risking my neck is one thing—risking yours is another."

"I'll get out if you want me to."

"Don't be silly. What we've got together is worth all the flame jewels in the system. Get dressed. We're going to see Rotsler."

It was still dark when they left the apartment. While they stood on the curb waiting for the robocab they had called the little guy in the new airsuit Barney had seen in the coffee stand came up to them.

"Mr. Lowell? Mr. Barney Lowell?"

"Yeah?"

"I'd like to talk to you. I'm from—"

"I'm sorry, but we're in a hurry. Maybe tomorrow."

"Oh, but it's very important," he rushed on quickly. "I have some papers here—"

Standing there in the cold night he looked a little sad, a little confused, and more than a little bored by the whole thing. Barney had him pegged now. One of the army of grey little government men whose only job, it seemed, was to shuffle papers, shake their heads sadly, and worry about the fact that nobody paid much attention to the Martian government, such as it was. There was probably a misplaced comma on Barney's visa, or something of the sort.

"First thing tomorrow," Barney said.

"But I insist—"

Just then the cab pulled into the curb, and Barney pushed Dorothy into it, fol-

lowing her and slamming the door in the face of the little man.

"You hurt his feelings," Dorothy said, laughing. She had dressed in a smartly tailored airsuit that revealed more than it concealed, but still kept out the biting cold. Barney thought he was the most fortunate of men.

He had met her in a restaurant a month before, in the belt, when they had been forced by crowding to share a table. The King Node had just been discovered, and it seemed like every miner in the system was passing through Belt Center on the way out. They were lucky to get a table at all. Dorothy had been alone, a Belt Company employee who had worked out her contract and had refused to sign up again or go to work as a prostitute for Rotsler Enterprises, was damn near broke, and they had clicked at once.

Once they had gotten to Mars she and Barney had walked in the parks, visited the First Landing Site, and picked out a small, cozy apartment before he had told her about the rock. She hadn't been impressed. She didn't even believe the part about Eagleton until someone had taken a shot at them one night. They had changed apartments the next day, and for two weeks had kept out of sight.

Now they must be getting close to Rotsler's place," Dorothy said. "My skin's starting to crawl."

Back in the jumbled reaches of Thunderburg, near the edge of the dome, in an area inhabited only by derelicts and on-the-run assassins, there is an im-

"All right," Barney said, "you've got the big red stone and the pure-bred bitch. What happens now?"
Eagleton smiled. "Now we pay the piper."

pacted sand building, completely windowless, as if it was out in one of the craters instead of under the dome. A house of pleasure known only as *Bill's Place*. It was one of the lesser-known pieces of Rotsler Enterprises. It wasn't an easy place to get into. Entrance was gained by knocking the appropriate number of times on a steel door, once the outer lock door of an exploration ship and damn near impervious, being scrutinized by a lumbering giant of a man, if he can be called that, who once went too long without oxygen and now has little brain left, then walking the length of a clammy corridor that made a perfect trap for those who the management did not want to leave.

Once through the corridor you entered a clean, well-lighted place. There were at least fifty prostitutes dressed harem-fashion, hung with real jewels worth a fortune. When you see a man at the bar in a ruffled poisonous green sports shirt, a man with a gleaming bald head and fringed grey beard and moustache and one gold tooth, a man who is almost eighty and looks one-hundred and eighty, you know you have come face to face with Rotsler, ex-artist, ex-lover, ex-human being, and currently, one of the richest men on Mars.

Rotsler set his glass of Earth-imported orange juice on the bar, looked Barney over carefully, and said, "Barney, my friend, I have been expecting you."

"Glad to hear it. I want to make a deal."

Rotsler sighed. "Figured that."

"A month ago you offered me half-a-mil for the stone. It's robbery, but I'll take it. I want out of this rat race."

Rotsler smoothed the ragged remains of his moustache with a forefinger. "It was two months ago. The price has gone down."

Dorothy and Barney exchanged glances. "How far down?"

"There isn't any price. Not any more."

Dorothy glared at him. "First you want it, now you don't. What are you after?"

Rotsler smiled. "Call it life insurance. I have the feeling that if I had my hands on that rock, my policy might run out."

"Why?" Barney asked.

"Because you and that stone, my friend, are hotter than a runaway pile. The word is out that Eagleton wants that rock. Now, what Eagleton wants, Eagleton gets. Even a straight dealer will shy away from that rock as long as Eagleton is around. I wouldn't touch you with

ten-foot waldos. Sure, I could buy and sell Eagleton ten times over, but a fight with him isn't worth the trouble. He's nuts, and crazy men make bad enemies. In fact, you make me nervous just being here, because I wonder, maybe, is a bomb going to go off and blow hell out of the joint, just to get the two of you?"

"You're despicable," Dorothy said. "Healthy, too." He turned back to his drink. As far as he was concerned, Dorothy and Barney had ceased to exist.

Outside there wasn't a cab in sight, and they walked down long, empty sidewalk. Barney felt cursed the way the mariner was cursed, but the albatross around his neck was flame-red.

He didn't see the sandcar at the end of the street until they were almost on top of it. It stood in the mouth of an alley, lights out, starlight gleaming faintly on its black flanks. Barney stopped, turned Dorothy around, and they started back the other way. "Just keep walking," Barney whispered. "Take it slow and easy."

Behind them the lights of the car came on and it moved out of the alley, not hurrying, rolling slowly towards them along the silent street. Barney pounded on the door to *Bill's Place*. The viewplate gleamed for a second, then died. Barney grabbed Dorothy and pulled her along the street, trying not to run, while the sandcar came slowly on behind them.

There were two of them, of course. The second car roared to life in front of them, blinding lights in their faces, tires squealing on the rubberoid street surface as it boomed towards them. Barney nearly yanked Dorothy's arm off as he stumbled into an alley, running blindly into the darkness. Behind a filthy pile of garbage cans they turned, crouched and waited.

Both cars stopped at the mouth of the alley and two men got out. They stood very still and looked into the alley, as if they were waiting for something.

"Barney."

"What?"

"Barney," she said again, and he felt the firm little push against his back. "Get up and walk out of the alley, Barney."

He turned and looked at her. Her eyes were calm and she held the little gun very steadily.

"Start moving, Barney."

He couldn't think of anything to say, but she must have seen it all in his face because she said, "I'm sorry, Barney. Honest to God, I'm sorry."

"How precious can one rock be?"

"I didn't know it would work out this

way. I wasn't supposed to—oh, hell—move!"

He grabbed for the gun—too late.

Something exploded just behind his right ear. Everything went far away and drifted slowly back. His arms felt limp and useless, and when a lot of hands grabbed him he kicked out with his legs and this time the universe exploded into complete blackness.

There were voices somewhere, and a sound of laughter. He opened his eyes and looked at the ceiling. He was laying on his back on the stone floor in *Bill's Place*.

"Perfect," Eagleton said reverently. He stood under a strong light, examining the flame jewel, a jeweler's glass attached to his spectacles like a third glittering eye. "I've never seen anything like it. It holds color even in artificial light."

Dorothy sat on a high bar stool, her long legs neatly crossed, idly swishing a drink around in a tall glass. "I worked hard enough for it."

"You outdid yourself, honey," Eagleton said. He walked over and kissed her on the ear. "You'll get a fat bonus for this."

"Sure," she said. She didn't look at Barney.

Rotsler and two of Eagleton's goons sat at a table. "All right," Rotsler said, "you guys have run all the paying customers off, and you've got what you wanted. Why don't you get out of my place now."

Without even glancing in his direction Eagleton said quietly, "In a minute, Rotsler."

Barney stood up uncertainly. Eagleton looked up and smiled. "Well, well. The clown prince awakens. Why didn't you listen to me out in the belt, son? Could have saved you a lot of trouble." He was small, stooped, mostly bald, with watery blue eyes and three wattles of chin.

"All right," Barney said, "you've got the big red stone and a pure-bred bitch. What happens now?"

He smiled. "Now we pay the piper."

Dorothy looked startled. "Why? Couldn't you just let him go? You've got the stone."

"Your concern for my well-being is touching," Barney said. "How much is he paying you?"

"Enough," she shrugged.

"And the whole thing—the meeting, the cozy little apartment, the love—it was all planned?"

For the first time her eyes came up to meet Barney's. The light had been there, but he could have sworn she was crying.

"I can't have you running around saying I lifted your flame jewel." He looked up at Barney, then pulled a 15 mm recoilless from his coat and sighted it.

"Oh, Barney, if you hadn't been stupid enough to keep the damn thing around your neck, I could have lifted it in your sleep."

"Sorry to be so much trouble."

"Oh, shut up," Eagleton said absently, still looking at the stone. "Don't misunderstand, son. There's nothing personal about this. But I can't have you running around saying I lifted your flame jewel." He looked up at Barney, then pulled a Remington 15mm recoilless from his coat and sighted along the barrel.

Barney stood rooted to the floor. There was something tight in his chest, and nerves tickled where he knew the slug would strike.

"Wait," Dorothy cried suddenly, and she stepped toward Eagleton, a look of pleading on her face.

And the gun roared.

Dorothy's head snapped back, twisting awkwardly to one side, and her hands came away crimson from her throat as she sagged to the floor. The slug slammed into the wall near Barney's head.

Eagleton started. His open mouth worked silently, as if trying to form some obscene apology. He looked stupidly down at his smoking gun. The three men at the table sat unmoving, staring, like figures in a wax museum.

Barney hurdled Dorothy and crashed into Eagleton, grinding the heel of his hand into his nose. Eagleton roared with pain and brought his arms up. Barney grabbed his gun arm and tried to twist it from its socket. There was a satisfactory clatter as the gun hit the floor. The jewel glittered in Eagleton's other fist. Barney yanked at the hand, clawing, twisting, wrenching the stone free, and spritely for the dark corridor.

"Get him!" Eagleton shouted.

The heavy thunder of slug-throwers and the hiss of lasers echoed in the corridor, but somehow all their shots missed. Footsteps pounded after Barney. He slid the bolt on the steel door and ran out into the still-dark and silent street. A slug skittered and screamed on the pavement, inches from his foot. He stumbled and fell like a tree, rolling, getting beyond the black sandcar, and came to a sudden halt against a pair of legs.

Barney knew then it was all over, and his flesh crawled in anticipatory horror.

The little man who looked like any other grey government clerk looked down at him and said, "Citizen Lowell, I'd like to talk to you."

Barney stared up at him. "Are you out of your goddamned mind?"

Down the street Eagleton and the two men fired wildly into the dark night, then pounded down the sidewalk towards Barney.

"It seems," the little man said thoughtfully, "that you have in your possession a rather valuable gemstone."

Barney stood up and gaped at him. "For Crissake—"

A slug smashed through the sandcar's windshield and the glass filmed into a sunburst of streaks, a ragged hole the size of a fist at its center.

It finally got his attention. "Who are those men?" he asked, sounding a trifle annoyed.

"Nobody much. Just some guys who want to kill me."

"Kill you?"

"Fellow named Eagleton."

"Oh, yes, Eagleton. We have an interest in him."

Barney had always assumed that those little clerks went through life armed with nothing more lethal than a ballpoint, but from inside his airtight he pulled a heavy-duty Mauser laser that had an aperture that looked to Barney like a tunnel. As Eagleton and the two men came down the street he fired.

The blue laser beam lashed out with a roar, rather than the polite hiss of a standard pocket laser. It caught the lead man somewhere in the chest and a cloud of steam enveloped him as his blood was vaporized. Eagleton dropped down on the other side of the sandcar. Barney didn't see where the other man went. He got down on his hands and knees and crawled around the rear of the car to meet him. It was very quiet all of a sudden. Barney crawled on his belly, thinking about Eagleton waiting for him with a gun. From the other end of the car came the sudden bark of a weapon, and Barney wondered if the clerk had bought it.

He felt the tire of the car. Then he was pushing his head around the tire, and he felt something cold against his forehead. Something round and cool, like a small coin.

"The stone," Eagleton whispered.

"Yes, sir," Barney said, because he knew what the thing against his forehead was. He fumbled in his pocket and brought up the stone. He couldn't see a damn thing, but he could feel. He knew just where the gun was, and he took a long breath and slammed the stone against it, hard.

The gunshot rattled his eardrums, and the flash was so bright and quick it seared his eyeballs. He rolled away in pain, covering his face, and then he

remembered that he had to keep trying for the gun and in the pitch-black darkness he clawed at Eagleton, at his arms and clothes and face.

He was oddly still, like a dummy or a sack of sand. Then Barney recoiled when he felt Eagleton's face. Most of his face was gone. The back of his pistol had blown off when the jewel plugged the barrel, the blast and pieces of metal almost tearing his head off.

Barney sat up, then heard footsteps coming around the car towards him. He didn't give a damn. He just sat there.

"Mr. Lowell," the clerk said, "may I talk with you now?"

And then Barney thought of Dorothy, and something cold knotted up inside of him. He got up and ran back inside the building, slowing just long enough on the sidewalk to scoop up the gun the dead goon had dropped. Dorothy sat slumped at the table, her face a bloodless white, while Rotsler fussed over her like a mother hen, trying to dress the wound. It wasn't as bad as it had looked. Along the lower left side of her neck was a furrow you could put your little finger in. There was a lot of blood, but it wasn't really dangerous.

She stared dully up at Barney. "How can you stand to look at me?"

"It's easy," he said.

She shook her head. "It didn't work out the way it was planned. I wasn't supposed to fall in love with you. At first it was just a job. Later I realized that they had us either way. If I didn't turn you over to them, they'd have killed us both. If I did—well, I thought they'd let you go. Barney, I know I can't ask you to believe in me, ever again, but—"

Barney didn't say a word. He just smiled down at her, then lifted the pistol in his hand and blew a neat, round hole in the center of her forehead.

The clerk cleared his throat loudly. "Citizen Lowell, may I talk with you now?"

Barney looked at him, still smiling. "Sure. Now you can add a charge of murder to the one of smuggling the jewel onto Mars, or whatever charge it was you had against me."

"Please, Citizen Lowell. You are under a misapprehension. I don't work for the government. Allow me to introduce myself. Eric von Blaude of the New York Metropolitan Museum. We're prepared to offer you two-million dollars, tax-free on Mars, for the flame jewel."

"Sold!" O

ALL THE SOUNDS OF THE RAINBOW

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When the flash passed, he saw that she was in the throes of one of her own; her eyes staring sightlessly out to sea, her lips twitching, her nostrils flaring. For a moment, he was overcome with curiosity as to how she was experiencing him; then, with a small effort, he put this distasteful thought from his mind, knowing that this was the moment of true divorce, that the alimony was now the only bond that remained between them.

A moment later, without a word to each other, they both got up and went their separate ways. *As Karen walked through the glass doors into the house, Marvin saw a billowing spongy green mass, and heard her hysterical trapped hammering beat time for her march out of his life forever.*

And time became the flickering procession of sheets of flashing images. The sun set over the cliffs into the Pacific, over a globe of orange fire dipping into the glassy waters and painting the sky with smears of purple and scarlet, now the smoky tang of autumn fading into the sharply crystal bite of winter night, now a slow-motion peal of enormous thunder dying slowly into the velvet stillness. The morning light on the porch of the beachhouse was a shower of blood-warm rain, a field of orange radiance shot with mists of cool blue, a humming symphony of vibrating energy.

For Bill Marvin, these had become the natural poles of existence, the only time-referents in a world in which night might be the toasty woman-smell of his bedroom darkness, the brilliant starry night of cool sheets against his body, or the golden light of anonymous female flesh against his, in which day was the corruscating fireworks of food crunching between his teeth, the celestial chime of his hot body hitting the cool water of the pool after the curry flavor of the sauna, the billowing green clouds of the surf breaking against the foot of the cliffs.

People floated through this quicksilver wonderland as shifting, illusive constellations of sensory images. Ricky-tick piano. Chemical female musk. Cloud of Havana smoke. The wail of an electric guitar. Peppermint and red wine. Hysterical, confined gonging. Smoked chili peppers. Garlic-and-peptic gall. The melancholy wail of a gypsy violinist playing hot jazz on a tuba. The sights and sounds and tastes and smells and feels that were the sensory images of the residents of Golden Groves interpenetrated the images of the inanimate world, blending and melding with them, until people and things became indistinguishable aspects of the chaotic whole.

Marvin's mind, except in isolated moments, consisted entirely of the combination of sensory impulses getting through to his brain at any given time.

He existed as the confluence of these sensory images; in a sense, he *became* his sensory experience, no longer time-bound to memory and expectation, no longer a detached point of view sardonically bouncing around inside his own skull. Only in isolated stretches when his synesthetic flashes were at momentary ebbs did he step outside his own immediate experience, wonder at the strangeness in his own mind, watch himself moving through the trees and cabins and people of Golden Groves like some kind of automaton. At these times he felt a certain vague sense of loss. He could not tell whether it was sadness at his temporary fall from a more sublime mental state, or whether his ordinary everyday consciousness was mourning its own demise.

One morning, when the granola in his mouth had scattered jewelled images of sparkling beads as he crunched it against a coffee backdrop of brown velvet, Harry Krell held him back as he started to walk out onto the porch for his morning booster session.

"This is day thirty for you, Marvin," Krell said.

Marvin stared back at him dumbly, hearing a hollow, brassy wail, seeing a rectangle of bright orange outlined against deep blue.

"I said this is the last day you've paid for. Either pony up another \$500, or send for someone to take you back to L.A. You won't be in any shape to drive for about a week."

Marvin's sensorium had changed again. He was standing in the cool living room near the open glass doors, through which sunlight seemed to extend in a solid chunk. "Thirty days?" he said dazedly. "Has it been *thirty days*? I've lost count." Lord, he thought, I was only supposed to be here a week or two! I haven't done any work in a month! I must be nearly broke, and the alimony payment is past due. My God, thirty days, and I can hardly remember them at all!

"Well I've kept good count," said Krell. "You've used up your \$500, and this is no charity operation. . . ."

Marvin found his mind racing madly like some runaway machine trying futilely to catch up with a world that had passed it by, desperately trying to sync itself back in gear with the real world of bank statements, alimony courts, four-day shooting schedules, rubber checks, vice squad hassles, recalcitrant actresses, greedy backers. If I can cast something in three or four days, maybe I can use the same cast to shoot three

"As Karen walked through the glass doors into the house, Marvin saw a billowing spongy green mass, and heard her hysterical trapped hammering beat time for her march out of his life."



quicks back-to-back, but I'll have to scout three different locations or it won't work, that should give me enough money to cover the monthly nut and keep Karen's lawyers off my back if I get all the money up front, pay them first and kite checks until—

"Well Marvin, you want to write out another \$500 check or—?"

"What?" Marvin grunted. "Another \$500? No, no, hell, I'm broke, I've already been here too. . . I mean, I've got to get back to LA immediately."

"Well maybe I'll see you around again sometime," said Harry Krell. He walked into the brilliant mass of sunlight leaving Marvin standing alone in the shadowed living room, and as he did Marvin saw a brilliant pulse of sunshine yellow, heard an enormous chime, felt a terrible pang of paradise lost.

But there was no time to sort his head out. He had to call Earl Day, his regular cameraman, get him to come out and drive him back to Los Angeles in the Targa. That could put together three concepts on the way in, start casting tomorrow, have some money in four or five days. Gotta make up for lost time fast, fast, fast!

For the barest moment, Bill Marvin was enveloped in rainbow fire which sputtered and crackled like color tv snow, and he heard the zipping, syncopated whooshing of metal birds soaring past his ears, igniting phantom traces of memories almost forgotten after the frantic madness of grinding out three pornos in less than a month, slowing his racing metabolism, catching for a fleeting instant his psychic breath.

Then he was back stiff-spined in the driver's seat of his Porsche, his hands gripping the wheel like spastic claws, the engine growling at his back, barreling down the left lane of the Ventura Freeway at 75 mph in moderate traffic. The flash had come and gone so quickly that he hadn't even had time to feel any sense of danger, unlike the first time he had tried to drive, only five days out of Golden Groves, when he nearly creamed out as the road became a sharp melody through rumbling drums up in the twisty Hollywood Hills. Now the synesthetic flashes were few—maybe one or two a day—and so transient that they weren't much more dangerous behind the wheel than a strong sneeze. Each one slipped through his mind like a ghost, leaving only a peculiar echo of vague sadness.

The first couple of weeks of production, on the other hand, had been a real nightmare. Up until maybe ten days ago

he had been flashing every half hour or so, and strongly enough so that he hadn't been able to do his own driving, so that takes had been ruined when he tripped out in the middle of them, so that the actors and crew sometimes thought he was stoned or flipping and tried to take advantage of it. Fortunately, he had made so many pornos by now that he could just about do it in his sleep. The worst of it had been that making the films was so boring that he found himself actually waiting for the synesthetic flashes, concentrating on them when they came, even trying to anticipate them, and experiencing the actual work as something unreal, as marking time. He was never much interested in sex when he was shooting porn—after treating female bodies like meat all day it was pretty hard to get turned on by them at night—and the only time he had really felt alive was when he was flashing or involved in one of the hundreds of horrible hassles.

He made an abrupt three-lane jump and pulled off the freeway at Laurel Canyon Boulevard, drove across the tacky-tacky of San Fernando Valley, began climbing up into the Hollywood Hills. The Valley side of the Hills was just more flatland style suburban plastic, but once across Mulholland Drive, which ran along the major ridge line, Laurel Canyon Boulevard curved and wound down towards Sunset Strip, following an old dry streambed through a deep gorge that cut through overgrown and twisted hills festooned with weird and half-hidden houses, a scene from some Disney Black Forest Elf cartoon.

Usually, Marvin got a big lift out of leaving the dead plastic landscape of lowland Los Angeles for the shadowy, urbanized-yet-countrified world of the Canyon. Usually, he got a tremendous emotional surge out of having finished one film—let alone three—driving away from it all on the last day of cutting, with any one of a dozen readily available girls already waiting at the house for him to start a week-long lost weekend, reward for a job well done.

But this time, the drive home did nothing for him, the end of the final cutting only left him empty and stale, and he hadn't even bothered to have a girl waiting for him at the house. He felt tapped out, bugged, emotionally flat, and the worst of it was that he didn't know why.

He pulled into his carport and walked around the side of his house into the seclusion of the unkempt, overgrown garden. Even the wild, lush vegetation

of his private hillside seemed washed out, pallid, and somehow unreal. The birdsounds in the trees and underbrush seemed like so much Muzak.

He kicked irritably at a rock, then heard the phone ringing in the house. He went inside, plopped down in the black leather director's chair by the phone stand, picked up the living room extension, and grunted: "Yeah?"

It was Wally Bruner.

"What's going on, Bill? I haven't heard from you in nearly two months, ever since you started in on that matter we discussed. I heard you'd started shooting three weeks ago, so I knew you weren't dead, but why haven't you gotten in touch with me? Did you get what you went there for?"

Marvin stared out of the picture window into the garden, where the late afternoon sunlight cast shadows across scraggly patches of lawn under two big eucalyptus trees. Two dun-colored morning doves had ventured out of their wooded seclusion to nibble at seeds in the grass and gobbie moodily to themselves like dowager aunts.

"What are you talking about, Wally?" Marvin said vacantly.

"Damn it, you know! Golden Groves, Harry Krell. Are we ready to proceed?"

Suddenly glowing bubbles of pastel shimmer were drifting languidly up through a viscous wine-colored liquid, and Marvin smelled the sweet aroma of perfect sunset; just for the tantalizing fraction of a moment, and then it was gone.

Marvin sighed, blinked, smiled.

"Forget it, Wally," he said. "I'm dropping the whole thing."

"What? Why on earth—"

"Let's just say that I went up on a mountain, came down, and want to make sure it's still there."

"What the hell are you talking about, Bill?"

"What the vintners buy," said Marvin.

"Bill, you sound like you've flipped."

"I'm okay," Marvin said. "Let's just say I don't give a damn what Karen spends her alimony on as long as I have to pay it, and leave it at that. Okay?"

"Okay, Bill. That's the advice I gave you in the first place."

After he hung up on Bruner, Marvin sat there looking out into his garden where ordinary dun-colored birds were pecking at a scruffy lawn, and the subtle gray tinge of smog was barely apparent in the waning light.

He sighed once, shuddered, shrugged, sighed again. Then he picked up the phone and dialed the number of Golden Groves. **O**

THE NEGLECTED MAJORITY

from page 58

to winning the prize. But hundreds have tried, and continue to try—testament to the power of the dream.

On smaller worlds men can fly. Robert A. Heinlein was probably the first to point this out, in a 1957 novelette, *The Menace From Earth*.

Imagine that you have wings strapped to your arms. They are light, nearly rigid plastic. They extend several feet beyond your fingers and are about two feet wide. On your feet are a smaller pair of ruders for guidance.

You are standing on an elevated platform, looking out over a large cavern. It is the inside of a dome, really, with most of the sunlight shielded out. The dome is two hundred yards high and even further across. You are near the top. You are admiring the view. Then somebody pushes you off the shelf.

You panic. Who wouldn't, high above the floor and with no visible means of support? But then you spread your arms, by reflex, and a mild, warm gust of wind picks you up. You rise. You have been pushed into an updraft, and you glide, rising without effort, without moving your arms.

A slight forward motion with your arms is rewarded with speed. Suddenly you are a bird, soaring and dipping, turning in the sunlight, catching air currents and riding them. Freedom, at last. Man will no longer envy the birds.

Of all things that can draw people to visit our moon—or any planetoid—I can't imagine any more filled with mystery and joy than the actuality of flight. No man has ever flown on wings yet, but I think it clear that the delicate tension between lift and gravity can be a great source of sheer physical enjoyment. Skiing, skydiving, surfing—these are pleasant approximations to the quintessential experience of flight.

Our moon will be the first world where men can fly. Even Ganymede, the largest moon of Jupiter, is a likely site, even though it is over twice as large as our moon. In general, low gravity is the major attraction of the small worlds; it gives every movement a new freedom, and can give new life as well. Unless some dark force within mankind stops the space program and robs us of the planets, the fascination of low gravity will draw men to our moon—and perhaps beyond, to the other planetoids.

Among the first to emigrate to the moon will be the weak and ill (or at least, those who can afford it). Without the pressing acceleration of earth's gravity, every effort requires less of the

body; blood pressure and heart rate can be very low. Though it is too early to be positive (and we may well be in store for some disappointing surprises), it may be possible to prolong human life significantly in low gravity environments. There is some evidence that zero gravity situations—such as the Apollo capsule in orbit or in transit to the moon—may upset natural rhythms and processes seriously, while light gravity does not. If this holds true, geriatric clinics may thrive on our moon before anything else.

Most physical activity is easier on the planetoids, but sometimes in unexpected ways. It's a mistake, for example, to think that because Ganymede's gravity is one quarter of earth's, a man can jump four times as high. Simple-minded arithmetic would say, if the high jump record on earth is about seven feet, then a comparable leap on Ganymede would be $7 \times 4 = 28$ feet. Several oldtime science fiction stories allowed their heroes to do precisely that—perform impressive leaps out of pits, craters and mine shafts on other worlds.

The correct arithmetic is more complicated. In all such problems, what matters is how far the center of gravity moves. A man's center of gravity is located somewhere in the middle of his stomach. This point is about three feet off the ground when the man is standing, so in a jump on earth the center of gravity moves about $7 - 3 = 4$ feet. It is this actual distance the center of gravity moves, 4 feet, that gets longer in low gravity situations. On Ganymede the 4 feet becomes $4 \times 4 = 16$ feet. Adding on the 3 feet of altitude the man's center of gravity started out with, we get $16 + 3 = 19$ feet that the center of gravity will move. This is quite a bit short of the 28 feet leap we calculated above.

Even walking will be different. The long, loping stride we saw in the Apollo moon broadcasts is the oldtime "space-man's walk" of the 1930 and 1940 science fiction. A man can use that stride to move faster than he can on earth. We might guess that he could move six times as fast, since the moon's gravity is one sixth of earth's. But in fact, because of changes in the frictional force, different angles the legs have to make with the ground, and so on, he only walks about twice as fast on the moon. And that's leaving out the trouble astronauts might have with bulky suits and awkward connections at the suit joints, too.

Since our moon promises so many of the features shared by the other

planetoids, it may seem pointless to explore the other thousands of small bodies in our solar system. Why not just stick to the planets, and our own moon?

For scientists, there is always the motivation of sampling the original material from which this solar system was built. And there is always, of course, the simple element of curiosity. From the two tiny moons of Mars, Phobos and Deimos, to the great families of moons that orbit the gas giant planets of Jupiter, Saturn, Uranus and Neptune, many riddles remain. Why does Saturn's Iapetus have one side dark and the other light? Why is Jupiter's Io reddish, when its other moons aren't? Why is Phobos so unaccountably gray—the darkest object in the solar system, in fact?

Perhaps the most enticing reason of all lies in the central question of the space program: does life exist elsewhere in our solar system? Commonly, we think of planets as the only refuge for life. There seems some small chance that Mars could support a viable ecology, if a supply of water persists there. Some biologists have not given up speculation that the upper cloud deck of Venus might be a haven for some microscopic organisms. Jupiter, the lion of the planets, with a thick atmosphere thousands of miles deep and composed of the elements that we think began life on earth—Jupiter seems a most hopeful candidate.

But to battle our way into the storms of Jupiter, where the ammonia clouds are swirling faster than the speed of sound, will require technology far beyond anything we have or can readily contemplate. Much time must pass before Jupiter can be sampled and life brought out.

What of the planetoids, then? The common argument is that they are small, cold and probably retain no atmosphere at all. Look at our own moon, goes the argument, one of the largest planetoids in the solar system. It is airless, rocky, dead.

These ideas may, after all, be right. But they shouldn't be accepted totally, because our basic ideas about life may be narrow minded. True, our moon has no atmosphere. But Jupiter's moons are over five times further from the sun and receive only four per cent of the sunlight our moon does. This means the process of boiling off gases from the surface is much, much slower. Also, the gases we know exist in quantity in Jupiter (and probably among Jupiter's moons) are heavy ones—methane and ammonia.

Some remnants of these substances might cling to the larger moons and provide an atmosphere.

In fact, recently some sensitive measurements of Ganymede have shown evidence of just such gases. The atmosphere is thin and cold—but it does exist.

Ganymede is cold and grim, for us. But life may not be restricted to the carbon-based forms we know on earth, and even as hostile a place as this out-sized moon should not be ruled out as a birthplace for life. Our familiar protein structure may be mimicked by some other organic material, swimming in ponds of ammonia. Some analog of our carbon-based DNA may pass on genetic information. It is impossible to estimate how improbable such a happenstance is without much more information on the basic problem of the origin of life. One point is certain, though—there is no reason to believe that ammonia-based (or methane-based) life is impossible.

Our space program, like any young child, promises more for the future than it can deliver today. There is a natural human interest in the question of life within our solar system. Travel to the other planets, either in person or with our machines as stand-ins, will unlock many of the riddles that cloud our own origins. What we find in our own solar system has implications for the general problem of life in the universe, as well. We may discover that some forms of life—even very simple ones—arise in even the extreme conditions of Mars, Venus or the gas giant planets such as Jupiter. If so, then life probably springs forth on many, many planets in the other solar systems of this galaxy. The stars teem with life, and some of it may even be intelligent. But to even make guesses about such things, we must know more about our own planetary neighbors.

If Mars and Venus prove unsuited for life, and Jupiter is too difficult to explore, space exploration may concentrate on the smaller bodies within range, particularly the moons of Jupiter and the large satellite of Saturn, Titan. It is just barely possible that some strange, truly alien ecology has evolved there. These little moons may then be the key to understanding the origins of life.

This may be the way things work out, as more and more information returns from our automatic probes, our Vikings and Mariners. Perhaps the planets are not crucial. If so, it will be a final, delicious irony for the neglected majority of planetoids. ○

THE SHORTEST S-F STORY EVER TOLD

Once upon a time Forrest J Ackerman submitted a story to the late Tony Boucher, then editor of *The Magazine of Fantasy and Science Fiction*, which was so short that Ackerman wired it in by Western Union!

For some years the late Fredric Brown held the record with "The last man on Earth sat alone in a room. There was a knock on the door."

Someone shortened it to "The last man on Earth sat alone in a room. There was a lock on the door."

And there were variations:

Lox on the door.

The last man on Earth set a loan in a room. With whom?

The last earth on man. Who buried him?

Etc.

Last year, in the anthology of original stories known as *GENERATION*, Roger Deeley came up with "The Shortest Science Fiction Story Ever Told": 3 words. Forrest J Ackerman selected it, as editor of the *Ace* annual anthology, as one of the Best SF stories of the year.

In between Brown and Deeley, Ray Bradbury—in a fanzine—came up with a 12-word tale of Earth's fate in *World War 3*, the nuclear one:

THE YEAR 2150 A.D.

In the year 2150 A.D. instead of one sun, there were two.

We asked Forrest J Ackerman, the master of the short sf story, if he could come up for *VERTEX* with The Shortest SF Story Ever Sold, and at first he came up with one that was one word shorter than the Deeley piece:

ATOMIGEDDON 2419 A.D.

THE END

Then he decided to go for broke.

Why stop at a one word story . . . which someone would eventually get the bright idea to top with a one letter story?

So Ackerman got the bright idea first.

An intriguing challenge: but was there an answer. Could it be done or was it an impossible task, senseless to ask? Could a story—any story—science fiction or mundane—be told with a single letter of the alphabet?

Ackerman has succeeded.

The story is harsh, downbeat, dystopian. Wylie in concept, Stapledonian in scope, it spans four and a half billion years and evaluates the entire history of mankind, every life ever lived, balances every terrestrial achievement against every human failing. An unforgettable tour de force. You have now but to turn the page to read the shortest science fiction story that will ever be told. Ever.

AN INTERVIEW WITH ROBERT SILVERBERG

from page 37

COSMIC REPORT CARD

Earth

(By Monitor 4SJ AKA MAN)

F

A—Excellent	—Recommended for Contact
B—Good	—Recommended for Assistance
C—Satisfactory	—Continue Observation
D—Fair	—Recommended for Modification
F—Failure	—Recommended for Termination

a serious extrapolation of a trend, at least not on the surface. Now, I don't for a moment believe we're going to have a robot Pope, but at the heart of it, it's a very serious story. The overt intent was satiric, surrealist, mocking; and that's the way I treated it. I don't design, I just follow along these trends where I'm dragged by the machinery.

VERTEX: What were your early influences in SF? Which were the stories and authors you liked best?
SILVERBERG: I began reading seriously when I was 12 or 13, so I was less concerned with matters of style than with vision. The writers who could show me unimaginable vistas of time and space carried me away. I read a lot of H.G. Wells first, and that was marvelous. I've never recovered from *The Time Machine*. That was the perfect SF novel. Then I moved on to Heinlein and the people who were writing SF in the early Forties. As I reached adolescence I began to think seriously about writing. The people who influenced me then were darker, more intense writers who were not terribly popular in the larger sense; the way Bradbury and Clarke were popular. C.M. Kornbluth, Henry Kuttner, Philip K. Dick, Fritz Leiber. People whose work has this almost feverish quality of power and vision; they shaped me. I don't know what influences are at work on me now. In my non-SF reading Faulkner has been a tremendous influence, not so much on my style as in various subjective things, a certain tone, a feeling. Joyce, Malcolm Lowery, various poets—I read a lot.

VERTEX: Of your own stories, which do you like best?
SILVERBERG: Well, there are certain stories I wrote simply because I wanted to read them, and no one else had written them. There's a novel called *Son of Man* which is strange, surrealist, dreamlike, and in a way a pipeline to my own unconscious. Although there's a lot of conscious literary craft there, the material, the imagery, came straight out of that dark place in the back of my head. I love that book. It didn't meet with any great popular acclaim, although it has a certain underground reputation. A novel of mine called *The World Inside* I like, partly because of the writing, and partly because it's my most complete exploration of the SF concept; closer to pure SF than most of my stuff; I developed a civilization

of an unusual kind and explored as many aspects as I could imagine. I like a number of my recent short stories because they make me laugh. I chuckle and say "how'd you think of that?" I generally like what I've written after it's done, but I hate it while I'm writing. I think most writers who are pretty good have a high regard for their own work. Not in an ego-trip way, but just as love of others starts with love of self, I think successful fiction begins with the belief that what you're doing is worthwhile.

VERTEX: What have you to say to aspiring science fiction writers?

SILVERBERG: I don't believe in aspiring writers. I think if a writer aspires he'll find the way by himself. There are technical tricks I could convey, I could sit down with the writer and say look, this is how you change viewpoint, or this is the importance of tense and gender, but a real writer finds his own way, fights his own war, and there's nothing I can say to him except I'll be very glad when he gets there because we don't have enough real writers. There's always room for somebody with unique and personal vision. I don't believe very strongly in writing courses or that kind of perpetual amateurism. I've attended, and taught at, a lot of writer's workshops, and I still believe that either the fire is within you or it isn't. You can learn your craft from someone else, but you can't learn the passion.

VERTEX: Do you feel that in order to be a writer you must have the passion and fire, to drive you to do the writing?

SILVERBERG: Not to drive you to write. But any artist ought to have a reason for creating other than simply making a living. The road is full of journeymen writers who put words on paper and sell them. I lived that way myself for a while. But nobody sets out to be a hack. Nobody at age 18 or whatever says "I'm going to be a manufacturer of commercial fiction." No, that's a road they get onto later on. I think that if somebody wants to be a writer badly enough he will become a writer. Yes, fire and passion are necessary. If you see the world and say "Wow! I must get this down on paper," and once you have it down on paper it will look like nothing else anyone has put down. It's in putting it down that you will learn the craft—pick up the carpentry.



VERTEX: Is that, then, the difference between a master and a journeyman writer?

SILVERBERG: Well, not entirely. There can be journeymen who have the fire and no way to convey it to paper. As they develop the mastery, if they do, their work changes. There's been a tremendous growth in my own work over the years. When I was 22 I thought I knew all the tricks—and I didn't. Howevermuch better I am now is partly because I am that much older and partly because I have that much more input. Partly because I've learned how to shape the material. Partly because I'm a different person, a richer self.

VERTEX: One more thing. There are a lot of people out there who respect your writing and views. Is there anything you'd like to say to them?

SILVERBERG: I'm not much for editorial statements. I would like to say that there's a wonderful universe out there. Open your arms to it and let it all come rushing in. Now and then I say that in my fiction. But no explicit message other than that it's a wonderful and extraordinary world we're in, and how good it is that it's here, and that we're here at the same time.

VERTEX: Thank you very much, Mr. Silverberg. ○

"... I was less concerned with matters of style than with vision. The writers who could show me unimaginable vistas of time and space carried me away. I've never recovered from The Time Machine."

SOYLENT GREEN

from page 15



JOSEPH COTTEN (top) stars in *Soylent Green* as William Simonson, a top official of the Soylent Company, which provides food for most of the world, while the late **EDWARD G. ROBINSON** (bottom) acts as the researcher for police detective Thorn, played by **CHARLTON HESTON**.

depends upon government-rationed synthetics and plankton derivatives made by the Soylent Company, which feeds half the world. A job is considered a rare privilege, and death is the only sure profit as each corpse is worth \$50 to the next of kin.

As the film unfolds the brave new world of tomorrow depicts a powerful but unmanned police force as the only authority preventing bloody riots from engulfing the populace.

Charlton Heston, who plays detective "Thorn," is fortunate to be a cop and lucky enough to afford a squalid two-room apartment, which he shares with elderly Sol Roth (**EDWARD G. ROBINSON**).

Sol is Thorn's "book," or researcher. It is Roth's job to trace the background and whereabouts of those individuals whom Thorn investigates. He accomplishes this by conferring with other "books" at the Exchange, a pseudo-library in which the few remaining real books are zealously guarded.

Thorn is currently investigating the murder of wealthy William Simonson (**JOSEPH COTTEN**), a prominent member of the Soylent Company whose beautiful "furniture," Shirl (**LEIGH TAYLOR-YOUNG**), reveals that Simonson spent the last days of his life in a deep melancholy for which he offered no explanation. At the time of the murder, Shirl and Simonson's bodyguard, Tab (**CHUCK CONNORS**), were shopping in the black market, and it appears to Thorn that the pair may have set the man up for the killing.

Pressured by his chief, Hatcher (**BROCK PETERS**), to close the case, Thorn stubbornly resists because he feels that important people are involved. In a surprise visit to Tab's apartment the bodyguard's "furniture," Martha (**PAULA KELLY**), unwittingly gives Thorn his most important clue to the killing.

Sol has conferred with his fellow "books" and discovered a heinous, secret truth about the Soylent Company, which he imparts to Thorn at the last minute as the drama builds to a surprising revelation of the secret and a ray of hope for the future of mankind.

The futuristic suspense film was produced by Walter Seltzer and Russell Thacher. Richard Fleischer directed the Stanley Greenberg screenplay, which was based on the novel by Harry Harrison. **O**

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Just to give you an idea of how we're different, here's a sampling of what a few recent issues have covered:

Terrors in Toyland. How safe is your child's toy? "The Ralph Nader of the toy industry," Edward Swartz spells out the perils. And lists 30 do's and don't's for intelligent buying.

Witness for the Living Sea. Jacques-Yves Cousteau outlines 4 points that could keep the sea — and mankind — alive.

Vanishing Point. A regular feature. So far, we've considered the alligator, coyote, tule elk, sea otter, dolphin, brown pelican, wild mustang.

The New Panama Canal. What will it do to the waters, the islands, the people? Whom should you write — and why?

Keep Out of the Reach of Children. Cereals are healthy for TV, no so healthy for kids. A hard look at American way of breakfast, with cost and nutrient analyses of 33 breakfast

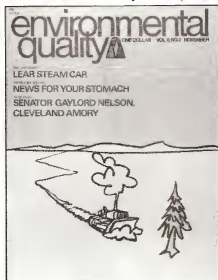
foods. Other articles have examined baby foods, hamburger, water fluoridation.

Strip Mining: The Prostitution of America. And the disgrace. Richard Cramer suggests other choices.

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